

USER'S MANUAL
Rev. 03/2006

CD3200 THYRISTOR UNIT

from 125A to 700A



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1 Warnings

1.1 Important warning for safety

This chapter contains instruction about safety. The non observation of these warnings can cause serious accident and the loss of life of operator. Serious damages can be also caused to the thyristor unit and to the component system in which is included.

The installation must be done by qualified people.

In manual description are used following icons.



Hazard: This icon is present in all operative procedure where if non executed properly can cause serious accident and loss of life of the operator.



Attention: This icon is present in all operative procedure where if not executed can cause faults to the thyristor unit.



Thyristor units are used in power industrial equipment. When the thyristor unit is working there are on the unit the following voltages.

- Maximum main supply voltage on power terminals up to 600 V.
- Auxiliary supply up to 690 Vac (see order code)
- Fan voltage 230Vac 50/60Hz (110V optional)

Don't remove the cover which provides adequate protection against electric shock. Don't use this thyristor unit in aerospace and nuclear application.



Electric Shock Hazard (Risque the choque électrique)

When thyristor unit has been connected to main supply voltage and is switched off, before to touch it be secure that the unit is isolated and wait at least one minute to allow discharging internal capacitors. Thus be secure that:

- access to thyristor unit is only permitted to specialized personnel;
- the authorized personnel must read this manual before to have access to the unit;
- the access to the units must be denied to unauthorized personnel.



Important warnings(attention)

Local regulations regarding electrical installation should be rigidly observed.

- Safety regulations must be rigidly observed.
- Don't bend components to maintain insulation distances.
- Protect the units from high temperature humidity and vibrations (see performances).
- Don't touch components to prevent electrostatic discharges on them.
- Verify that all rating are in line with real needs.
- If authorized personnel must measure voltage current etc. on units, take away rings and other jewels from fingers and hands.
- Authorized personnel working on thyristor unit under power supply voltage must work on insulated board. Be secure that board is not connected to earth.

This listing does not represent a complete enumeration of all necessary safety cautions.

**Protection(protection)**

CD3200 thyristor unit has an insulated cover to compliance to International specification IP20. To understand if IP20 protection is sufficient should be evaluated the installation place where the units are installed

**Earth(terre)**

CD3200 family has isolated heatsink. For safety connect the heatsink to earth to avoid shocks in case that circuit board or THYRISTOR lose insulation. Earth impedance should be correspondent to local earth regulation. Periodically the earth efficiency should be inspected.

**Electronic supply (alimentation électronique)**

CD3000 family electronic circuit should be supplied by dedicated voltage supply for all electronic circuit but not in parallel with contactor's coil, solenoids and other inductive or capacitive loads. It's recommended to use a shielded transformer.

**Electromagnetic compatibility (compatibilité électromagnétique)**

Our thyristor units have an excellent immunity to electromagnetic interferences if all suggestions contained in this manual are respected. In respect to a good Engineering practice, all inductive loads like solenoids contactor coils should have a filter in parallel.

**Emissions (emission)**

All thyristor switching at high speed generate some radiofrequency disturbance. CD3200 series compliance with EMC rules for CE mark. In many installations near electronic devices have not been noted problems. If radiofrequency devices at low frequency are used near the thyristor unit some precautions should be taken like line Filters and shielded cables for input signal and for load cables.

NOTES

We reserves the right to apply modifications to the our products without any advice.



The thyristor unit must be mounted vertically and with no obstruction above and below to allow good flow ventilation.

When mounted side by side leave a gap of 15 mm between the units.

Hot air of one thyristor unit must not invest the unit positioned above.

The maximum cabinet temperature must not exceed 45°C.

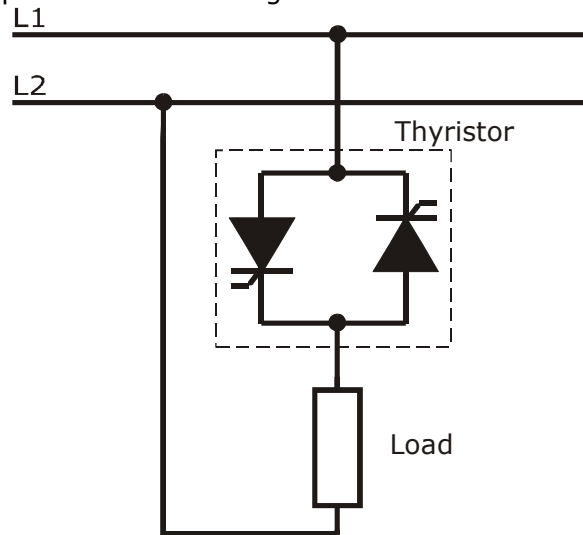


A suitable electromechanical device must ensure that the unit can be electrically isolated from the incoming line supply.



2 Introduction

A thyristor unit is semiconductor device which acts as a switch formed by two thyristors in antiparallel. To switch on the alternating current the input signal will be on and the thyristor will switch off at first Zero Crossing voltage with no input signal. The benefits of thyristor units compared with electromechanical contactors are numerous: no moving parts, no maintenance and capacity to switch very fast. Thyristors are the only solution to control transformers and special loads that change resistance with temperature and with age.



2.1 Advantages compared with analog thyristor unit.

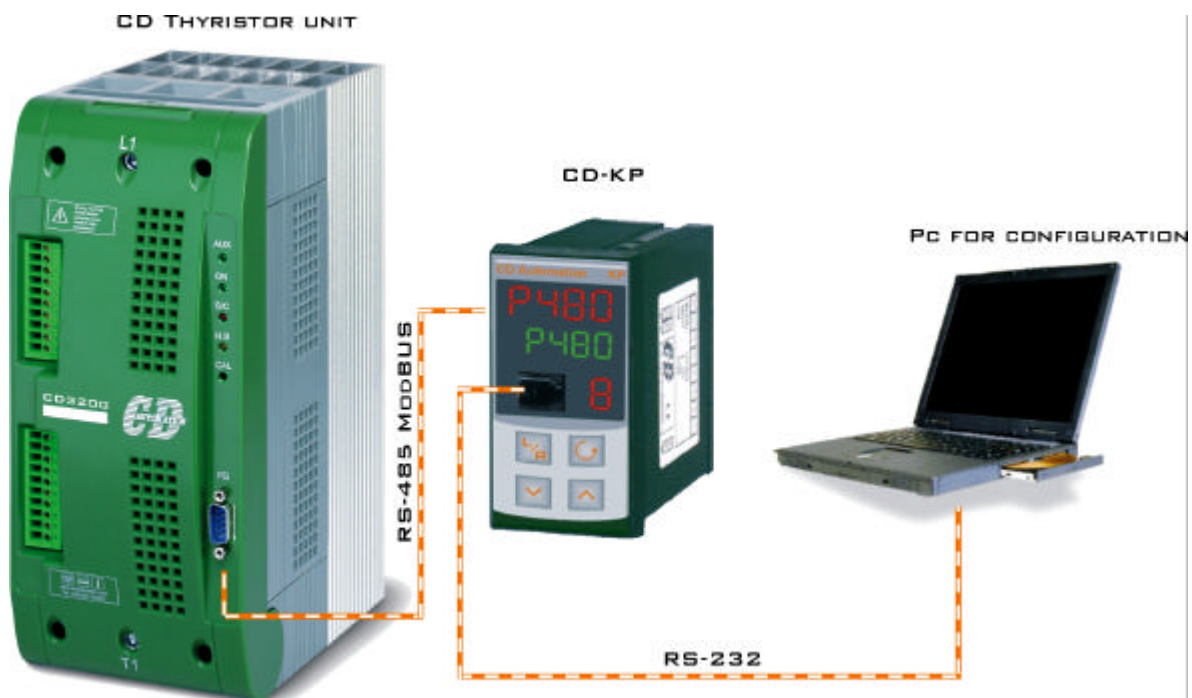
CD3200 can be connected via RS485 to an Industrial Personal Computer.

On serial link are available many information like: current, power, load status and all the parameters for diagnostic and configuration. Tele service and clone facility is also available.

The advantages over the analog and non "Full digital" versions are flexibility and the possibility to implement special features without to change any Hardware.

Several strategies can be implemented and selected via the parameter on serial link.

All these features are not available on analog thyristor unit that use also small micro just to perform dedicated task (Ex. for Heater Break Alarm).



On CD Automation web-site is available, free of charge, the Configuration Software.

A cable with its built in converter and connector is available from CD Automation.

The configuration cable can be plugged into the PG connector of CD3200, or if a CD-KP is available it's possible to have the connection above indicated on front unit.

This solution allow to engineers to verify configuration without to go inside the cubicle where there is high voltage and without to stop the plant.

2.2 CD-KP high lights

2.2.1 General description

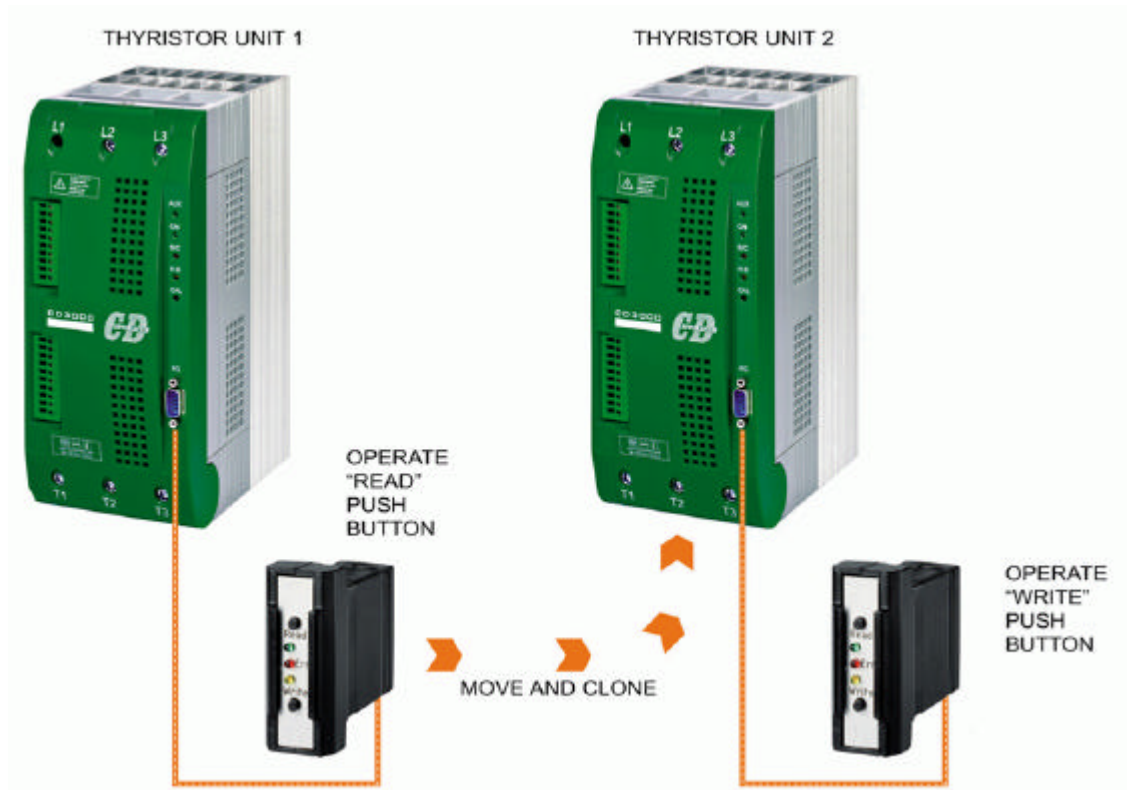
- Local/remote facility
- Set point ramp up/down
- Scroll selection of:
 - Set point power
 - Power read out
 - Current
- Display indication for:
 - Heater Break Alarm
 - SCR short circuit
- Retransmission (4-20mA or 0-10V selectable) of one of these parameters: power, current.
- Dimensions 48x96x92mm (WxHxD)



CD-KP is designed to give two access levels.

- First Level Access: the operator is able to view the power, current and voltage as well as set the power when the CD-KP is in Local Mode.
At this level the password function is disabled to prevent accidental parameter changes by unauthorized personnel.
- Second level access: By connecting a PC to the RS232 port, located on the front of the CD-KP, it's possible to have access to all parameters of the CD Automation Thyristor Unit using the free downloadable Configuration Software.
Configuration changes can be made interactively, without powering down the unit, removing the need to open the cabinet or to stop the process.

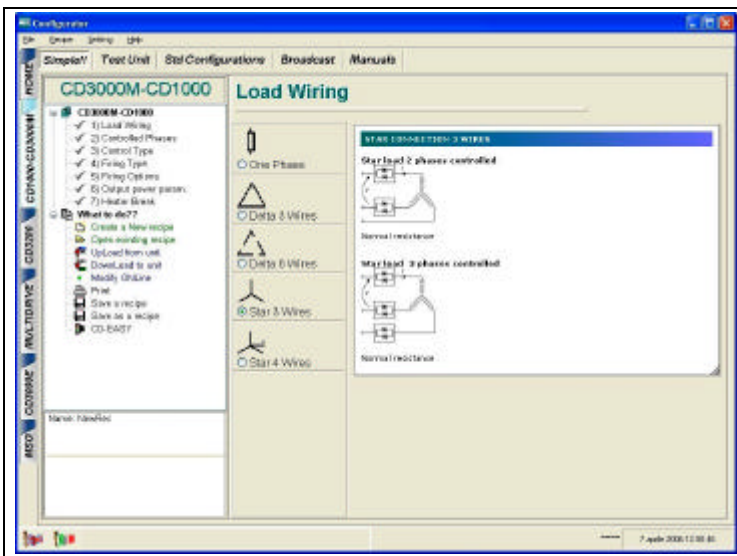
2.3 Clone facility using CD-EASY



CD-EASY is a Memory Support used by maintenance personnel in the shop floor. The Clone Facility makes it possible to copy the configuration of one Thyristor Unit and paste it into another in a matter of seconds. The CD-EASY can be loaded with the standard unit operating configuration and stored together with the system drawings in a convenient place, enabling unit reconfiguration within seconds if required.

For CD-KP and CD-EASY are available Maintenance Manuals on www.cdautomation.com.

2.4 Software Configurator



You can download the free software Configurator from our web site.
www.cdautomation.com

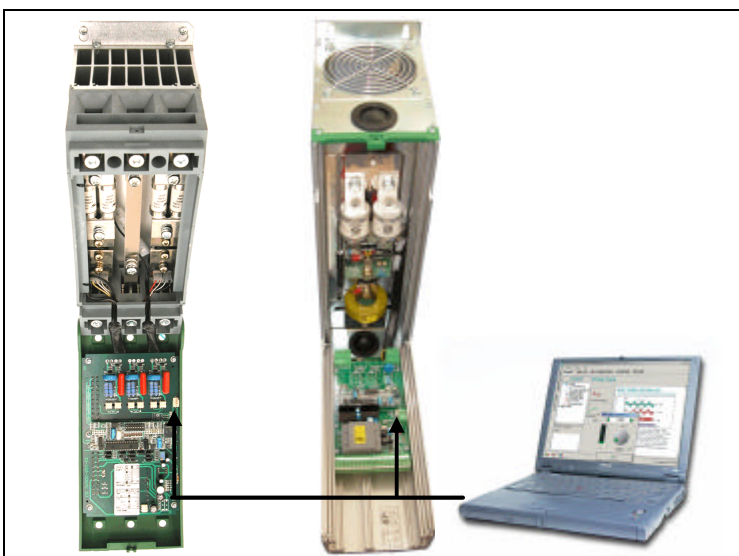
If the CD3200 code is in line with your requirement, providing that the operating voltage and Load current are inside the code the CD3200 has been already configured in our Factory and you are ready to run.

You need software tools only to modify the ordered configuration. Anyway we suggest checking the unit on the machine with the test section.



To install the software download it from the website, launch the installation program and follow the instruction on the screen.

To configure the unit you can use the standard communication port RS485 on terminals blocks or use the programming Cable and plug it inside the PG connector. (see par. 11.6)



Connect the other side of the programming cable to the PC RS232(9PIN) serial port.

Set the baud (=9600) and address (default=1) of PC serial port.

3 Quick Start



Attention: this procedure must be carried out by skilled people only.

If your CD3200 code is in line with what you really need, then the main configuration is already done by CD Automation and you just need to do the following steps:

1. Verify CD3200's current sizing. Be sure that:
 - the load current is equal or less than the nominal one of CD3200
 - the main voltage is equal or less than the nominal voltage of CD3200
2. Verify the Product code
3. Verify the Installation
4. Verify the Wiring:
 - all auxiliary connections must be done in line with wirings on this manual
 - verify that there isn't a short circuit on the load
 - verify that the Reset Contact on terminal 7 and 8 are closed
 - With External Enable option give Enable to the unit
5. Supply the auxiliary voltage of the unit
6. Supply the Fan at 230VAC $\pm 15\%$ 50/60Hz (110VAC $\pm 15\%$ 50/60Hz Optional)
7. Supply the Power unit
1. Makes Calibration procedure (see par. 10.2.2)

If your CD3200 code is NOT in line with what you really need, use the configurator software tool to set-up the unit.

4 CD3200 Sizing

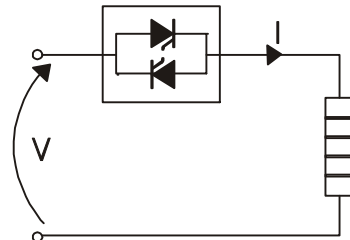
4.1.1 Wiring with resistive load

$$I = \frac{P}{V}$$

V = Nominal voltage phase to phase

I = CD3200 Nominal current

P = Nominal power to the load



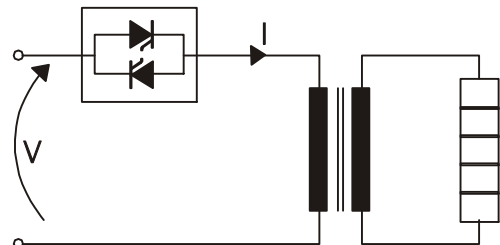
4.1.2 Wiring with inductive load

$$I = \frac{P}{V \cos \phi}$$

V = Nominal voltage phase to phase

I = CD3200 Nominal current

P = Nominal power to the load



5 Identification and Product Code

5.1 Identification of the unit



Before to install the CD3200 unit examine for damages or deficiencies. If any is found, notify the carrier immediately. Check that the product features shown on CD3200 identification label corresponds to that ordered (see par.5.2)

An identification label provides all the information regarding the factory settings of the unit. This label is on the unit, as represented below:

Identification Label

SUPPLY	AMPERE	INPUT	FeedBack	OPTION
125 <input type="checkbox"/>	400 <input type="checkbox"/>	0-10V <input type="checkbox"/>	V <input type="checkbox"/>	HB <input type="checkbox"/>
480 <input type="checkbox"/>	150 <input type="checkbox"/>	500 <input type="checkbox"/>	4-20mA <input type="checkbox"/>	V2 <input type="checkbox"/>
600 <input type="checkbox"/>	200 <input type="checkbox"/>	600 <input type="checkbox"/>	POT <input type="checkbox"/>	VxI <input type="checkbox"/>
	300 <input type="checkbox"/>	700 <input type="checkbox"/>	I <input type="checkbox"/>	EXT <input type="checkbox"/>
AUX V		FIRING		Fan
110 <input type="checkbox"/>			Soft Start <input type="checkbox"/>	110v <input type="checkbox"/>
230 <input type="checkbox"/>				
480 <input type="checkbox"/>				
600 <input type="checkbox"/>				
SERIE CD3200				



5.2 Ordering code

Model CD3200

	1	2	3	4	5	6	7	8	9
CD3200									
Ex:CD3200	500A	500A	400V	480V	90:130V	0÷10V	PA	V	HB

1	Max CURRENT of CD3200								
125A		200A		400A		600A			
150A		300A		500A		700A			
The Max CURRENT must be equal or more than nominal current									

2	Load CURRENT
Specify this value that will be used to configure the unit in CD Automation	

3	Load Voltage(incoming voltage supply)
Specify this value that will be used to configure the unit in CD Automation	

4	Max VOLTAGE of CD3200								
480V				600V					
The Max VOLTAGE must be equal or more than operating voltage									

5	Auxiliary Voltage								
90:130V	Da 90 a 130Vac; 10VA								
170:265V	Da 170 a 265Vac; 10VA								
230:345V	Da 230 a 345Vac; 10VA								
300:530V	Da 300 a 530Vac; 10VA								
510:690V	Da 510 a 690Vac; 10VA								

6	Input								
0÷10V	0÷10Vdc	POT	10KΩ potentiometer						
4÷20mA	4÷20mA								

7	Firing								
S+PA	Soft Start + Phase Angle								
PA	Phase Angle								

8	Feed Back								
V	Voltage	V2	Voltage square						
I	Current	VxI	Power (VxI)						

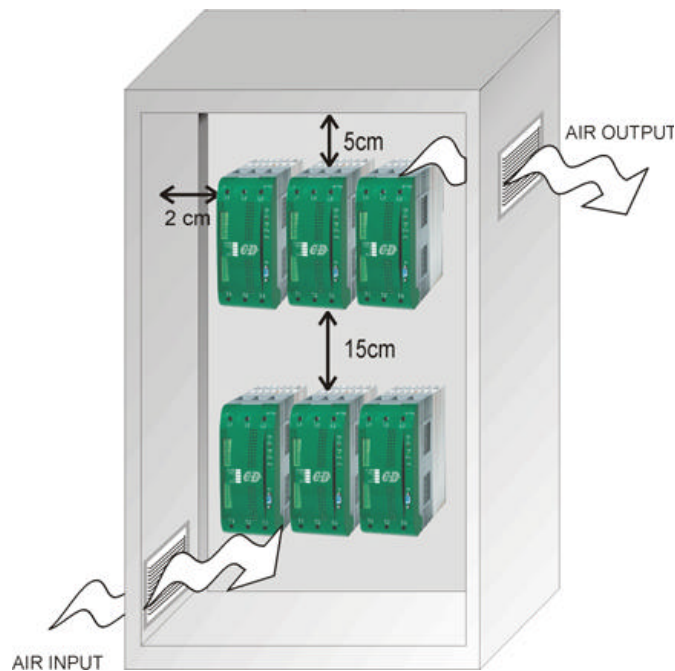
9	Options								
COMM	MODBUS protocol in RS485 is standard								
CD-KP	External Keypad								
IF	Internal fuses (standard for size from 125 to 700A)								
NF	No fuses								
NCL	No current limit								
CLP	External current limit profiling 0-10Vdc								
EN	Opto isolated external enable								
HB	Heater Break Alarm								
FAN110	Fan voltage supply 110VAC ± 15% (std 230VAC ± 15%) 14W 50/60Hz								
CD-EASY	External Protection IP20 for size S7C and S8C								
UL	Clone facility & memory card								

6 Installation



CD3200 unit should be always mounted in vertical position to improve air cooling on heatsink. Maintain minimum distances in vertical and in horizontal as below represented. Don't install in proximity of hot elements and near units generating electromagnetic interferences.

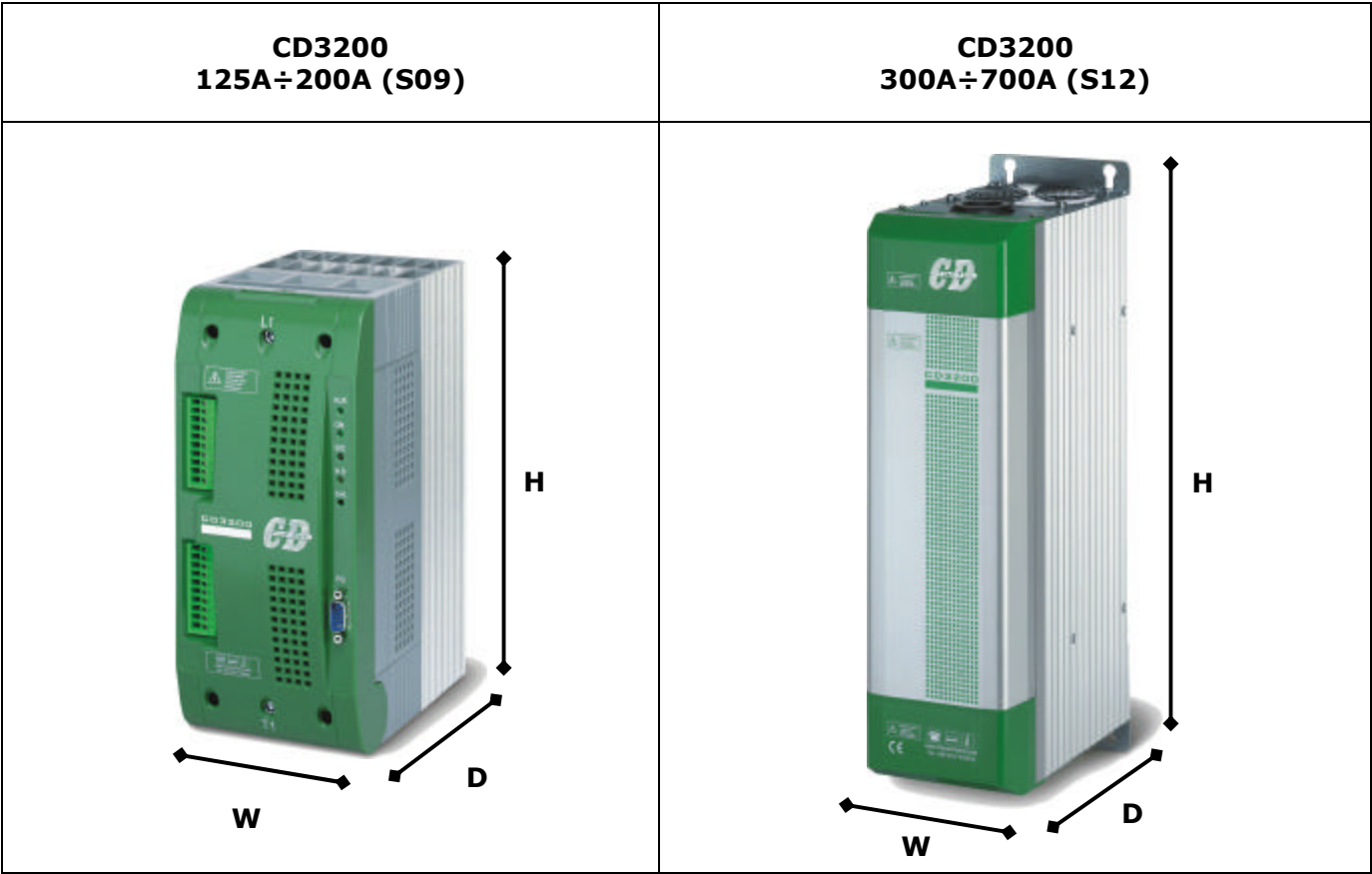
When many units are mounted inside a cubicle provide air circulation as below represented. Sometimes it is necessary to provide a fan to have better air circulation.



6.1 Environmental installation conditions

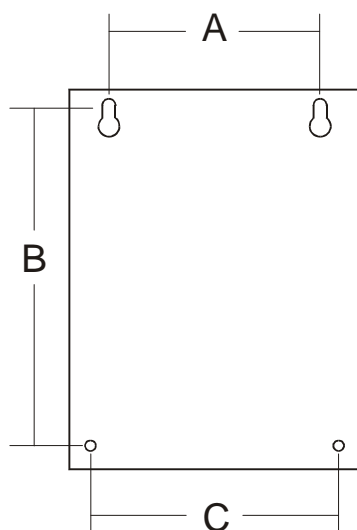
Ambient temperature	0-45°C at nominal current. Over 45°C use the derating curve (par.8.2)
Stocking temperature	-25°C to 70°C
Installation place	Don't install at direct sun light, where there are conductive dust, corrosive gas, vibration or water and also in salty environmental
Altitude	Up to 1000 meter over sea level. For higher altitude reduce the nominal current of 2% for each 100m over 1000m
Humidity	From 5 to 95% without condense and ice

6.2 Dimensioni



Size	W(mm)	H(mm)	D(mm)
125A (S09)	116	316	187
150A (S09)	116	316	187
200A (S09)	116	316	187
300A (S12)	137	520	270
400A (S12)	137	520	270
500A (S12)	137	520	270
600A (S12)	137	520	270
700A (S12)	137	520	270

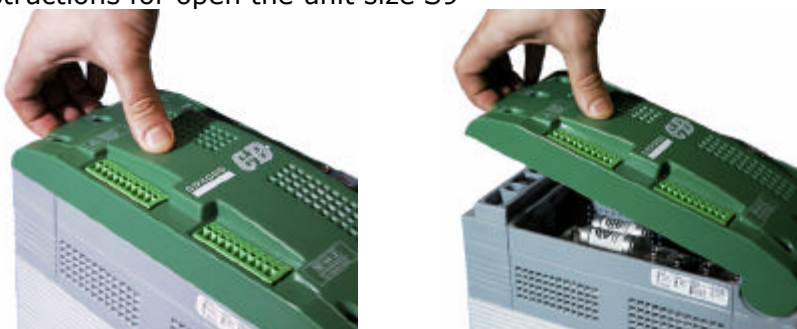
6.3 Fixing holes



Size	A(mm)	B(mm)	C(mm)
125A (S09)	96	290	104
150A (S09)	96	290	104
200A (S09)	96	290	104
300A (S12)	97	495	97
400A (S12)	97	495	97
500A (S12)	97	495	97
600A (S12)	97	495	97
700A (S12)	97	495	97

6.4 Removing the cover

Instructions for open the unit size S9



Instructions for open the unit size S12



7 Wiring instructions



Warning: this procedure can be done just by specialized personnel
CD3200 unit has isolated heatsink. For safety connect the heatsink to hearth using its terminal with hearth symbol.

CD3200 can be susceptible to airborne interferences from near equipment or from interferences on main supply, so a number of precautions must be taken.

- Contactors coils and chokes must have in parallel a RC filter and must be supplied with a different voltage line.
- All input/output signals must use screened bifilar wires.
- Signal input and output must not route in same cable try and must not be parallel.
- Local regulations regarding electrical installation should be rigidly observed.

7.1 Wiring details

Use copper cables and wires rated for use at 75 °C only, provided with the terminal type indicated below.

7.1.1 Power cable torque (suggested)

Current	Connector Type	Torque Lb-in (N-m)	Wire Range AWG / kcmil	Wire Terminal
125A, 150A, 200A,	Terminal Block M8	265 (30.0)	1 3/0	Copper wire Compact (Solid) Stranded
300A	Bus Bar with M8 screw	505 (57.0)	2x1/0 350	UL Listed (ZMVV) Copper Tube Crimp. Lug
400A	Bus Bar with M10 screw	505 (57.0)	2x3/0 600	UL Listed (ZMVV) Copper Tube Crimp. Lug
500A	Bus Bar with M10 screw	505 (57.0)	Bus bar 60x4mm	
600A	Bus Bar with M10 screw	505 (57.0)	Bus bar 60x5mm	
700A	Bus Bar with M10 screw	505 (57.0)	Bus bar 60x6mm	

7.1.2 Power cable dimensions (suggested)

Current	Supply			Load		
	Cable		Screw M	Cable		Screw M
	mm ²	AWG		mm ²	AWG	
125A (S09)	50	1	M8	50	1	M8
150A (S09)	70	1/0	M8	70	1/0	M8
200A (S09)	95	3/0	M8	95	3/0	M8
300A (S12)	2 x 70	2 x 1/0	M8	2 x 70	2 x 1/0	M8
400A (S12)	2 x 95	2 x 3/0	M10	2 x 95	2 x 3/0	M10
500A (S12)	Bus Bar		60 x 4 mm	Bus Bar		60 x 4 mm
600A (S12)	Bus Bar		60 x 5 mm	Bus Bar		60 x 5 mm
700A (S12)	Bus Bar		60 x 6 mm	Bus Bar		60 x 6 mm

7.1.3 Auxiliary cable dimensions (suggested)



Current	Auxiliary Supply			Earth		
	Cable			Cable		Screw M
	mm ²	AWG		mm ²	AWG	
125A (S09)	0,50	18		16	6	M6
150A (S09)	0,50	18		16	6	M6
200A (S09)	0,50	18		25	4	M6
300A (S12)	0,50	18		50	1	M8
400A (S12)	0,50	18		50	1	M8
500A (S12)	0,50	18		70	1/0	M8
600A (S12)	0,50	18		70	1/0	M8
700A (S12)	0,50	18		70	1/0	M8

7.2 Power Terminals



Before to connect or disconnect, make sure that power cables and auxiliary wires are insulated from live voltage.

Terminal	Description
L1	Line Input Phase 1
T1	Load Output Phase 1

CD3200 125A÷200A (S09)	CD3200 300A÷700A (S12)
	

7.3 Auxiliary Terminals

Terminal	Description
1	Auxiliary supply voltage (see par.5.2)
2	not connected
3	Auxiliary supply voltage (see par.5.2)
4	Ground
5	Fan supply voltage (see par. 8.3)
6	Fan supply voltage (see par. 8.3)
7	Reset
8	Reset
9	(+) Input command signal 0÷10V,4÷20mA,POT
10	(-) Input command signal 0÷10V,4÷20mA,POT

Terminal	Description
11	0v GND
12	Output +8Vdc stabilized 1 mA MAX
13	(+) Output command for Slave unit
14	(-)Output command for Slave unit
15	(+) External Calibration 24 Vdc max
16	(-) External Calibration 24 Vdc max
17	External current limit profiling 0-10Vdc (see par.11.3.3)
18	NC HB relay contact (Max 500mA , 125Vac) Optional (see par. 9.3.1)
19	Common relay contact (Max 500mA , 125Vac) Optional
20	NO HB relay contact (Max 500mA , 125Vac) Optional (see par. 9.3.1)



Auxiliary terminals

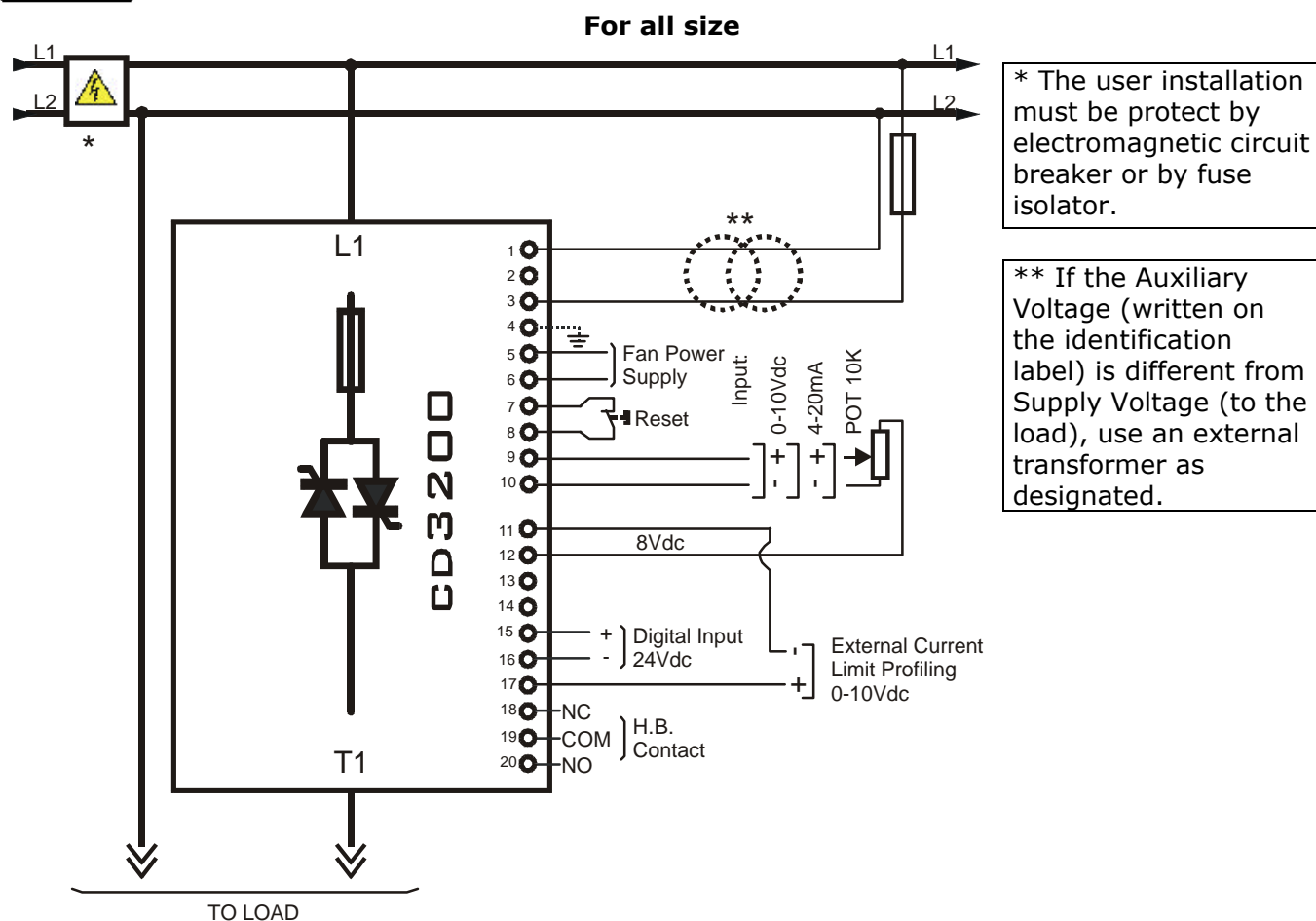


Auxiliary terminals

7.4 Diagram of control connection



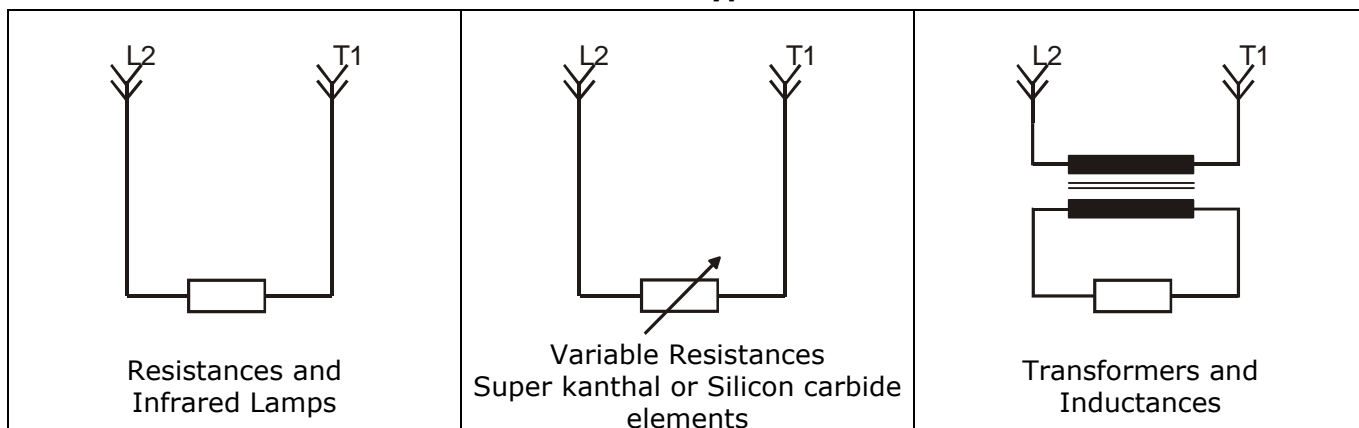
Warning: this procedure can be done just by specialized personnel.



NOTE:

- To work, terminals 7-8 must be linked.
- The auxiliary voltage supply of CD3200 unit must be synchronized with load voltage power supply (L2, L3).

Load Type

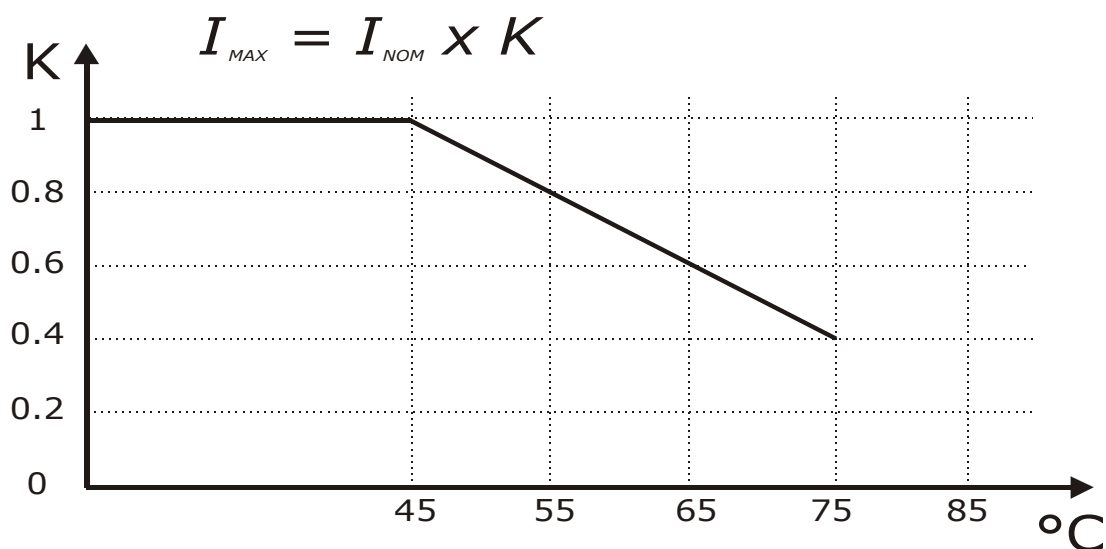


8 Technical features

8.1 Power output features

Current	Voltage range	Repetitive peak reverse voltage		Latching current	Max peak one cycle	Leakage current	I ² T value thyristor	Frequency range	Power loss	Isolation Voltage
(A)	(V)	(480V)	(600V)	(mAeff)	(10msec.) (A)	(mAeff)	tp=10msec	(Hz)	I=Inom (W)	Vac
125A	24÷600	1200	1600	450	1540	15	11300	47÷70	146	2500
150A	24÷600	1200	1600	450	2000	15	19100	47÷70	162	2500
200A	24÷600	1200	1600	300	4800	15	108000	47÷70	204	2500
300A	24÷600	1200	1600	300	5250	15	128000	47÷70	320	2500
400A	24÷600	1200	1600	200	7800	15	300000	47÷70	397	2500
500A	24÷600	1200	1600	200	8000	15	306000	47÷70	530	2500
600A	24÷600	1200	1600	1000	17800	15	1027000	47÷70	589	2500
700A	24÷600	1200	1600	1000	17800	15	1027000	47÷70	712	2500

8.2 Derating curve



8.3 Cooling fans

The CD3200 thyristor units are equipped with a cooling fan. the supply voltage is standard 230VAC $\pm 15\%$ 50/60Hz or optional 110VAC $\pm 15\%$ 50/60Hz.

The fan's power consumption is below listed:

Size	CE Number of fans	UL LISTED US Number of fans
S09	One Fan - 14W	One Fan - 14W
S12 fino a 600A	One Fan - 14W	Two Fan - 30W
S12 da 700A	Two Fan - 30W	Two Fan - 30W

9 Led status and alarms

9.1 LED Status Table

LED	STATUS	DESCRIPTION
For all Size		
Aux	○	Auxiliary supply is not connected
	●	Auxiliary supply is connected and board is OK
ON	○	OFF Condition(Load IS NOT Powered)
	●	ON Condition(Load IS Powered)
SC	○	SCR OK
	●	SCR short circuit
	⦿	no External Enable (see par. 11.4)
HB	○	Load OK
	●	Load Fault

○	= OFF
●	= ON
⦿	= Flashing

9.2 Events and alerts that don't stop CD3200

The following events and alerts don't stop the unit:

- SCR Short Circuit (only with the HB option)
- Heater Break (only with the HB option)

When one of these alarms is active, the HB relay change status.

9.3 Heater break alarm and scr short circuit (HB Option)

The Heater Break Alarm is a circuit to diagnostic partial or total load failure, short circuit on SCR and fuses failure.

- sensibility better than 20%;
- alarm stored in memory;
- this alarm is associated to relay output 0.5A at 125VAC.



The Heater Break circuit to work properly must have at least an input of 25% of the nominal current.

H.B. circuit read load current via a current transformer internal to the unit.

Minimum current is 10% of the current transformer size's.

The current transformer size's depending to the thyristor unit size.

9.3.1 HB alarm contact (Terminals 18-19-20)

CD3200 is supplied with a HB alarm contact

In normal condition (no alarm) and with auxiliary voltage the contact at terminals 19-20 is open (relay coil energized).

In alarm condition and without auxiliary voltage the contact at terminals 19-20 is closed (relay coil not energized).

Also you can use the NC (closed without alarm) contact at terminals 18-19

9.3.2 HB Calibration

An automatic function sets the Heater Break Alarm.

The auto setting function is described to par. 10.2.2

If load current decreases for partial or total load failure (sensitivity 20%) the yellow LED become ON and alarm relay change status.

If CD3200 is still in conduction with no input signal (LED green OFF) it means that there is a short circuit on thyristors and red LED (SC) become ON.

If the load has been changed calibration procedure must be done again.

9.3.3 Heater Break RESET

To reset Heater Break Alarm open RESET contact on terminal 7-8.

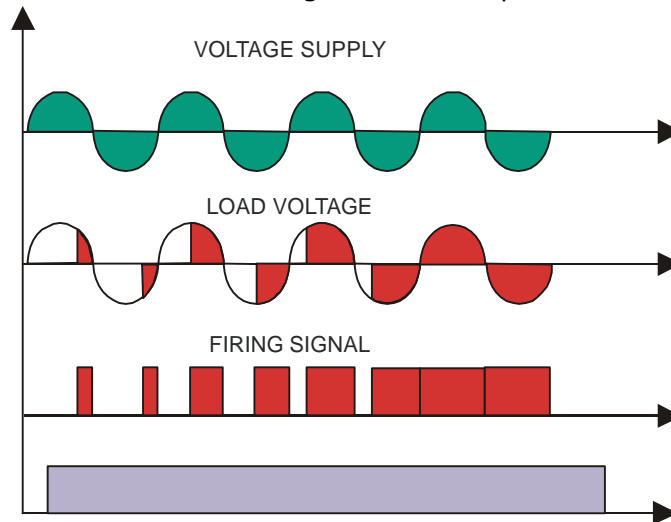
10 Types of firing mode



Warning: this procedure can be done just by specialized personnel.

10.1 Soft Start + Phase Angle (S+PA)

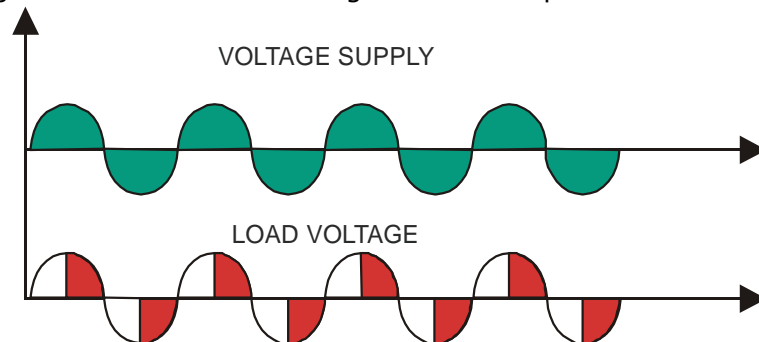
For change this Firing mode use software configurator or the parameter on serial link.



This is an additional feature to Phase Angle. The Unit start with a ramp that progressively increase the thyristor firing angle up to arrive to final value. Soft start is an important feature to reduce the inrush current with transformers when are switched ON and with cold resistance that are very close to a short circuit when cold resistance are switched ON.

10.2 Phase Angle (PA)

For change this Firing mode use software configurator or the parameter on serial link.

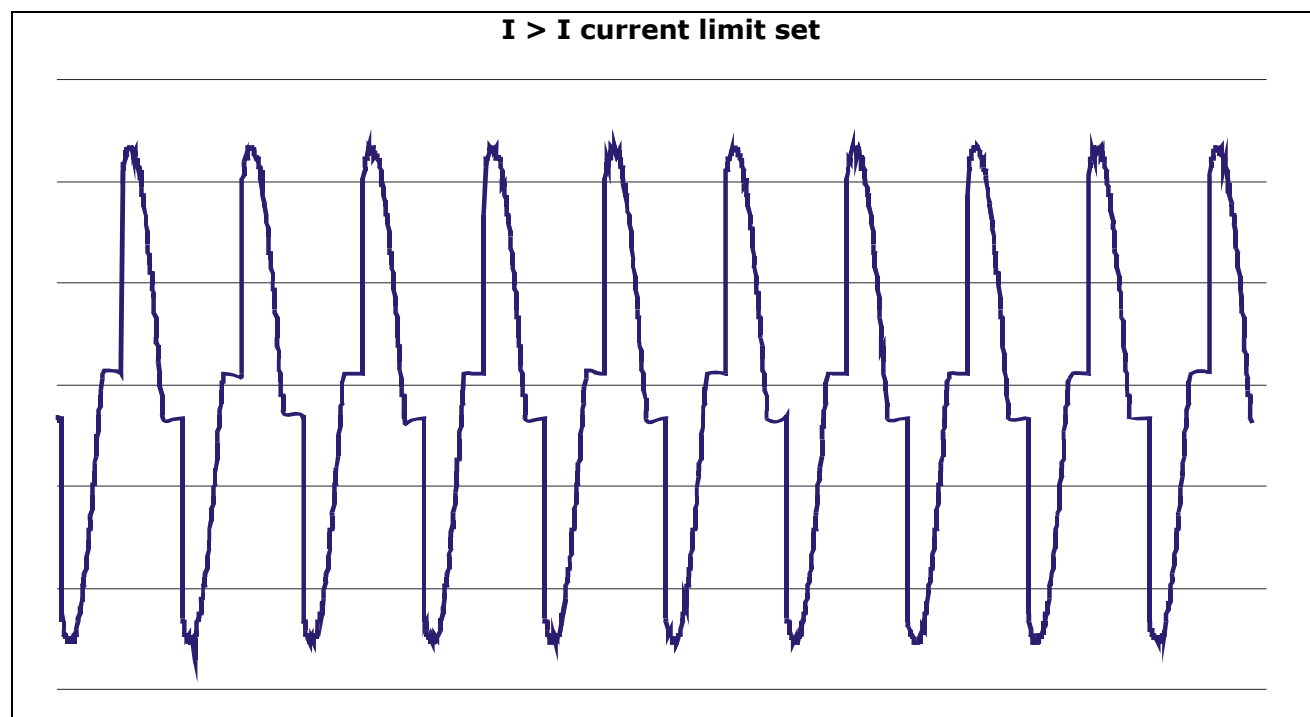
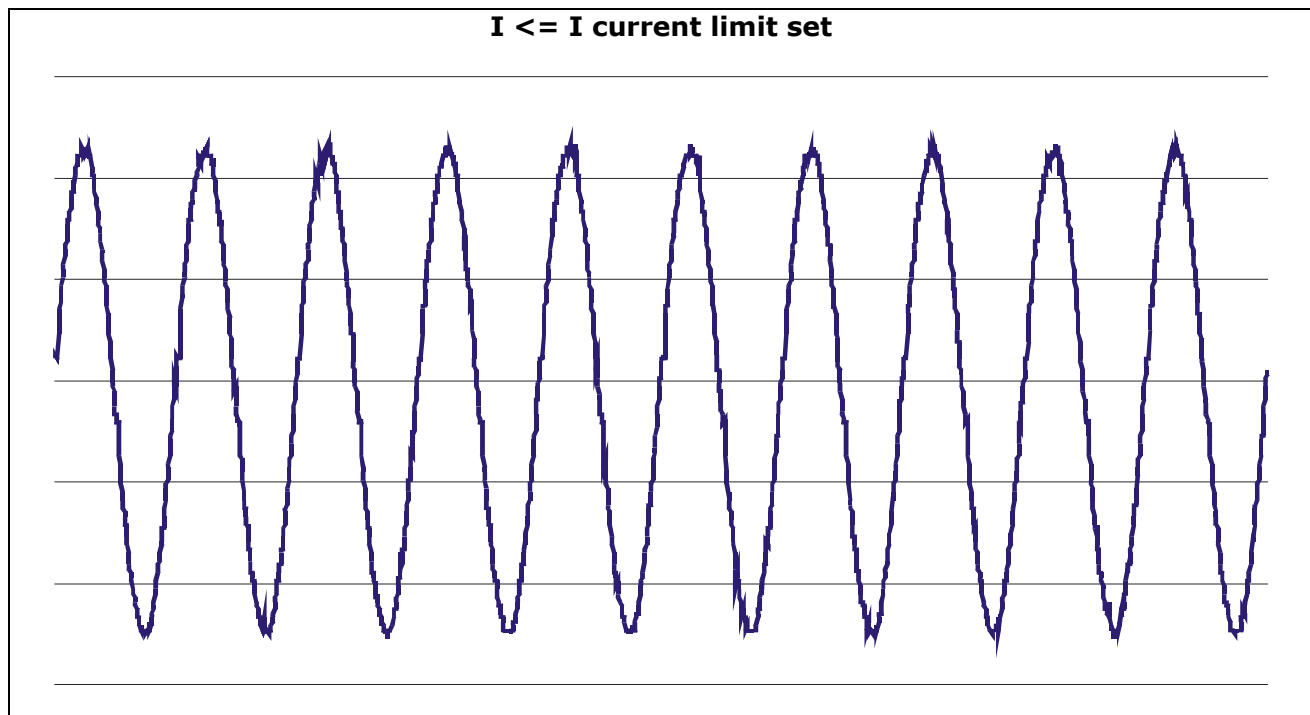


With Phase Angle is possible to control the power to the load allowing to Thyristor to be in conduction for a variable part of the voltage supply cycle. The load power can be adjusted from 0 to 100% as a function of analog input signal, normally delivered by temperature controller or by potentiometer. Normal it's used with inductive loads. The only disadvantage with phase angle is the generation of interferences that can be reduced with filters.

10.2.1 Current limit action

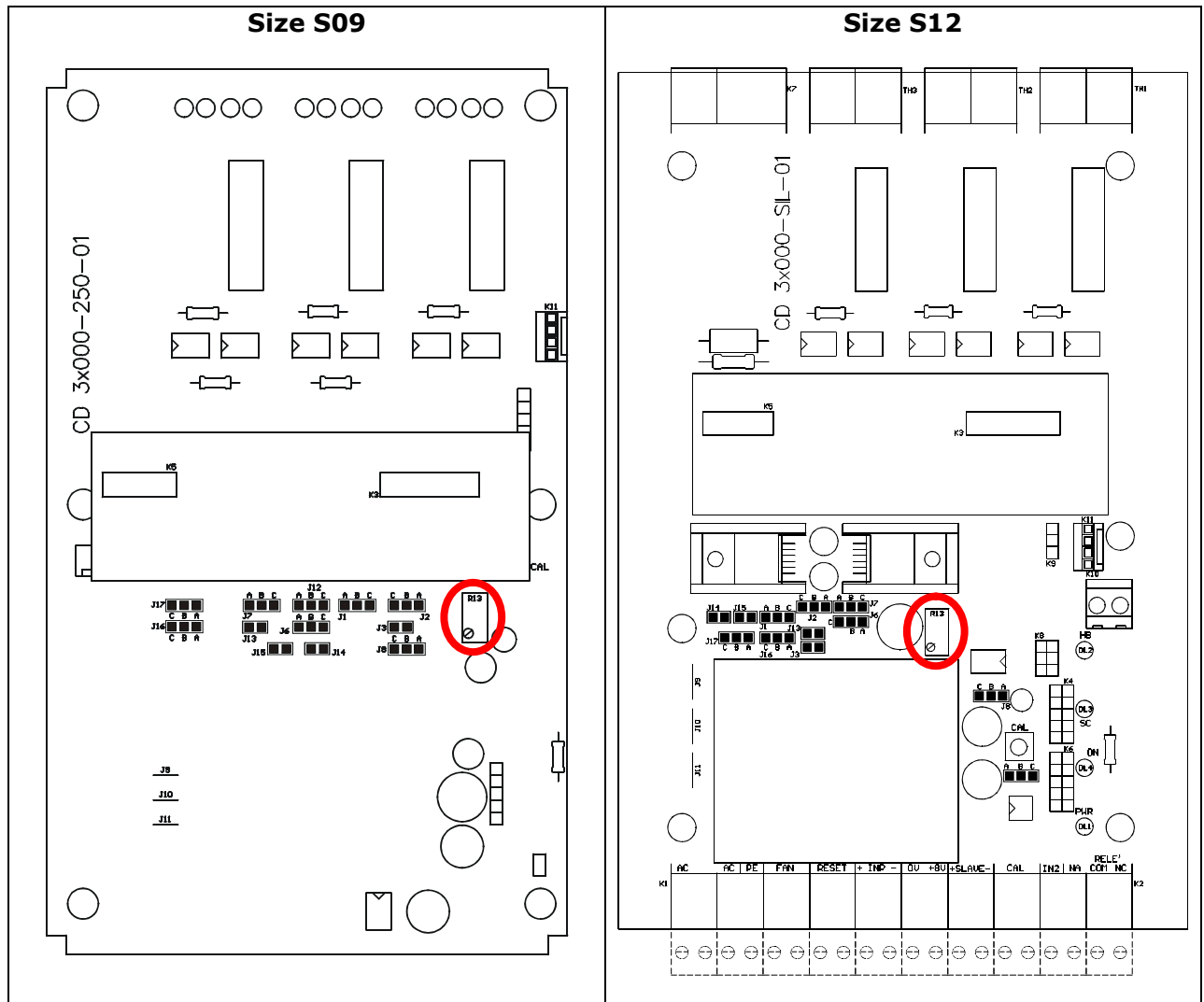
Usually with Phase Angle it is necessary to use the current limit when the CD3200 is connected to a transformer or cold resistance.

When the current to the load exceeds the set current limit value, the unit decreases the voltage output to maintain the current below the current limit set.



10.2.2 Calibration Procedure and Current limit set

The Current limit is set up through the R13 trimmer on Frontal Board PCB (see par.6.4):



Turned completely in counter-clockwise sense, will be Current limit = 0%.

Turned completely in clockwise sense, will be Current limit = 100% of the Max value of current transformer (25/0.05 ,50/0.05 o 100/0.05 depending on thyristor size).

Minimum current is 10% of the current transformer size's.

If the External current limit profiling is used, before turning the R13 trimmer, supplying with 10Vdc the secondary analogic input (see par. 11.3.3).

In order to make the Calibration Procedure, follow these indications:

- Turned completely in counter-clockwise sense the trimmer R13
- Start the Calibration using the Key "Cal" place on the frontal part of the S09 size unit or on the CD3x00 board for S12 size unit, or with the digital input (terminals 15-16).
- All LEDS are on, this means that calibration procedure is active.
- Turn the trimmer R13 in clockwise sense and set the wished current limit.
- After a minute the CD3200 comes back to the initial situation and the values of tension and current are saved in memory

If the load has been changed calibration procedure must be done again.

10.3 Feed-back (control mode)

The type of Feed-back select has already configured in line with customer requirements that are defined in the complete product code. The product code is written on the identification label. However, if you wish to change type of Feed-back use software configurator or the parameter on serial link.

If the digital input is set as Feed-back Selection (see par. 11.4), it's possible to change the select Feed-back with the Voltage Feed-back (V), simply activating the input.

The feed-back defines the Control Mode. It's possible to have:

- V=Voltage feed-back.
The input signal is proportional to the output voltage. This means that input signal becomes a voltage demand. This control mode compensate the voltage fluctuation of the incoming line supply.
- I=Current feed-back.
The input signal is proportional to the current output. This means that input signal becomes a current demand. This control mode maintain the current also if the load impedance changes.
- V2=Square Voltage feed-back.
The input signal is proportional to the output square voltage. This means that input signal becomes a power demand. The power remains constant if the load impedance doesn't change.
- VxI=Power feed-back.
The input signal is proportional to the power output. This means that input signal becomes a power demand. The power remains constant also if voltage and load impedance change. This feed-back is used with silicon carbide elements that change its resistive value with temperature and with age. In addition it compensate the voltage fluctuation of the incoming line supply.

If the user change the type of feed-back, it's necessary repeat the calibration procedure (see par. 10.2.2)

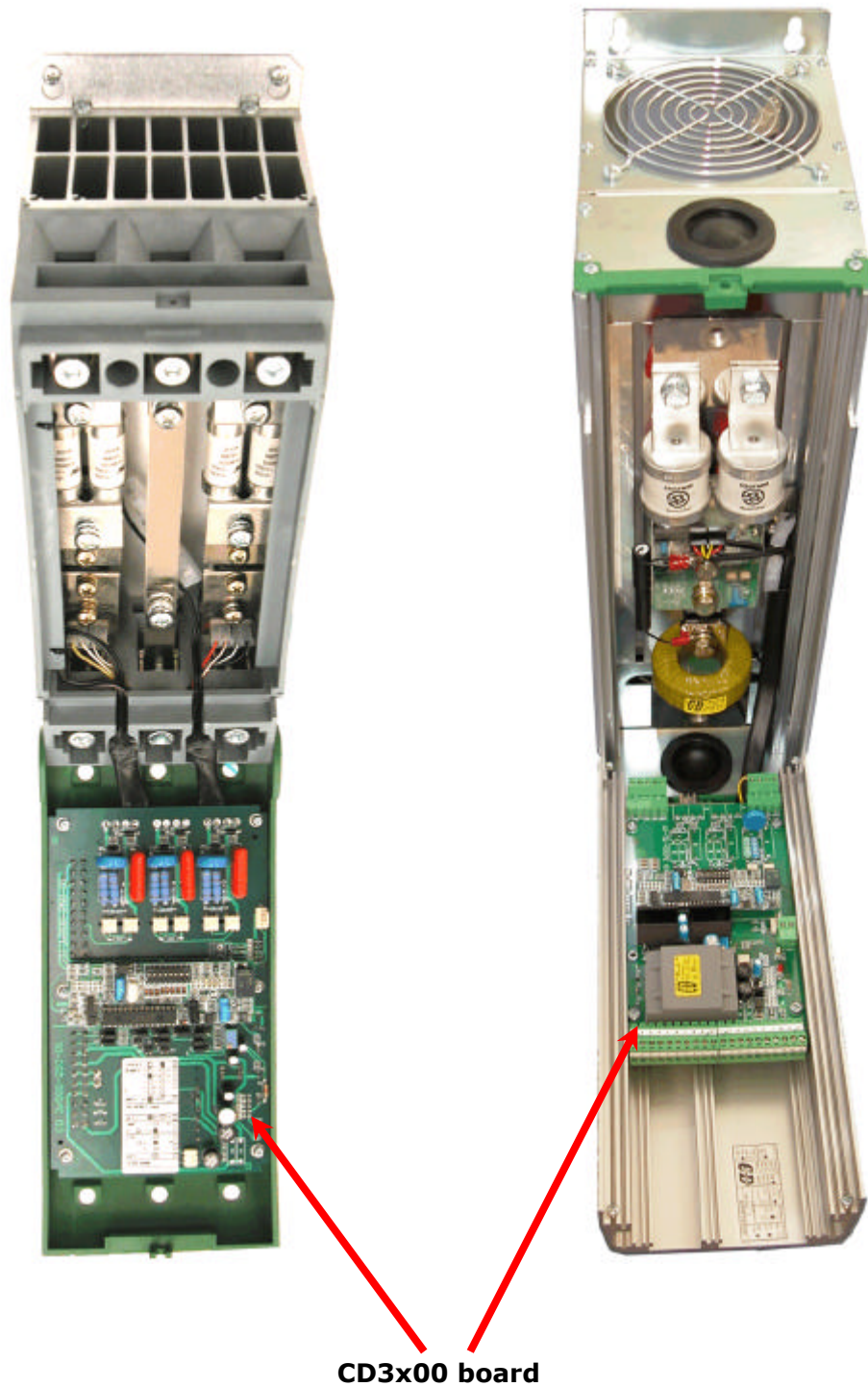
11 Connection description

11.1 Electronic boards

To have access to the electronic boards the user must removing the unit's cover(see par.6.4)

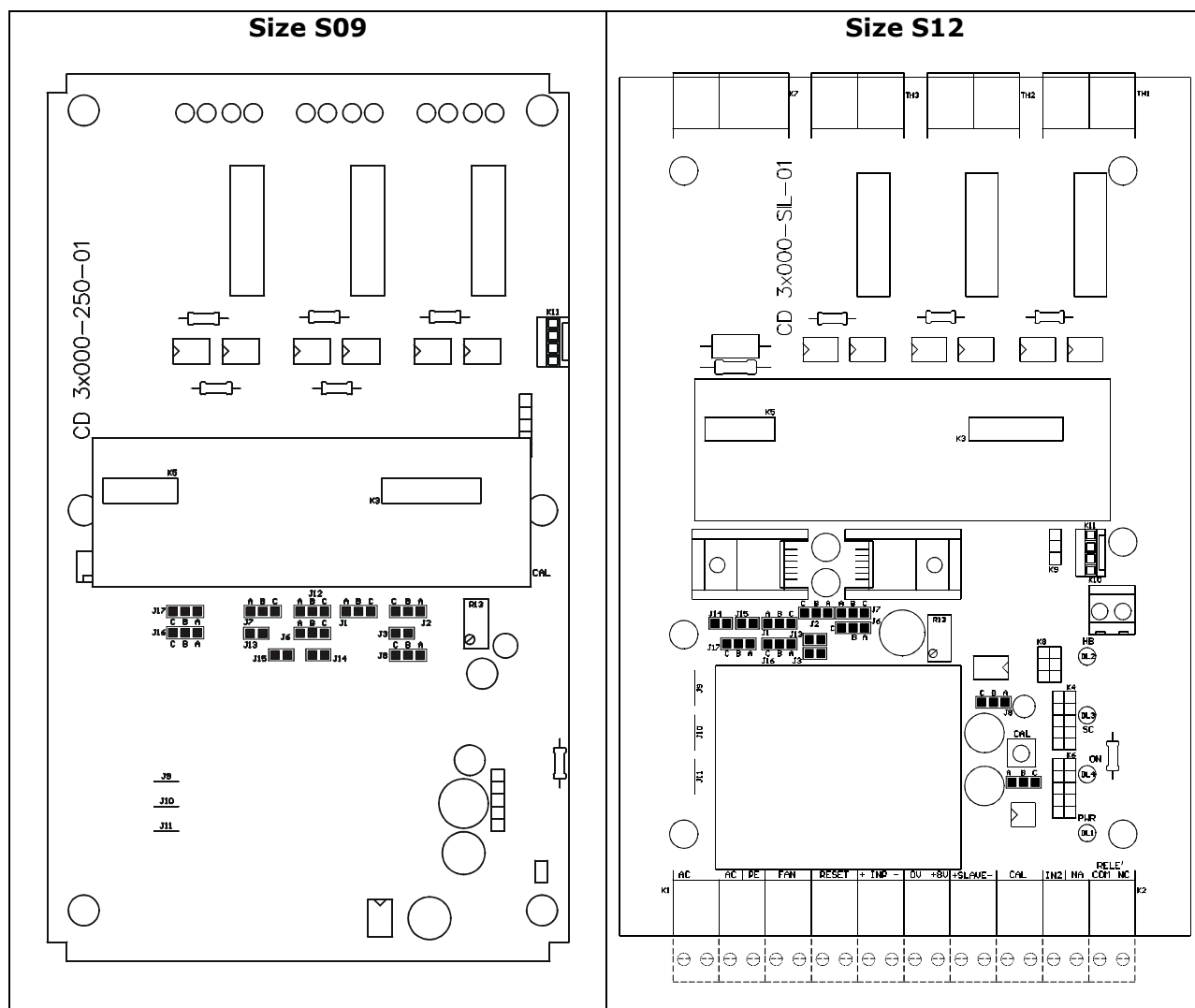


Warning: *this procedure can be done just by specialized personnel.*



11.1.1 Jumper's position on CD3x00 board

The jumper's position changes in function of the size.



11.2 Collegamento tensione ausiliaria

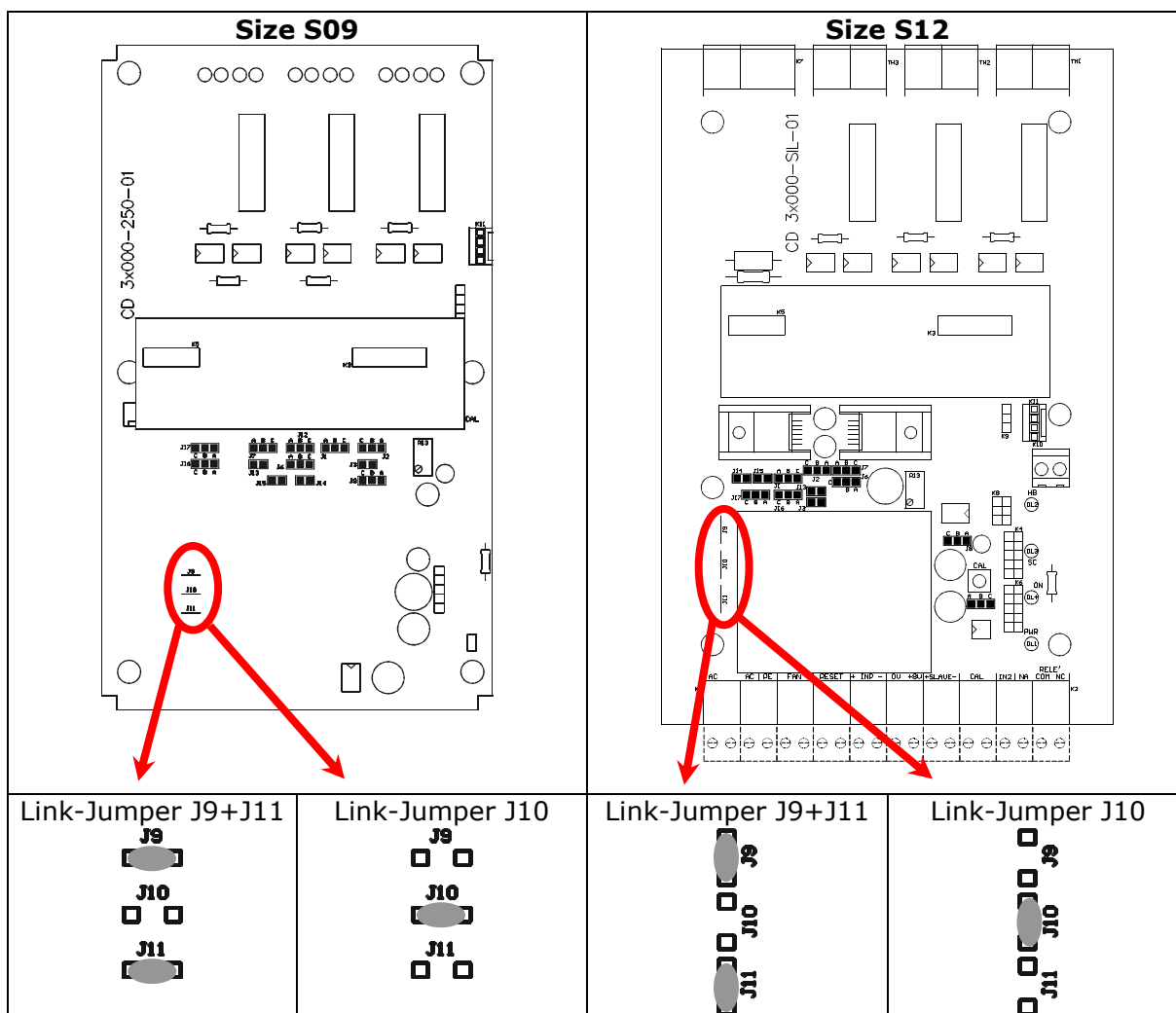
The auxiliary voltage supplies the electronic board, so check the nominal voltage on the label.

Terminal	Description
1	Auxiliary voltage supply (for the electronic board)
3	Auxiliary voltage supply (for the electronic board)

To change auxiliary supply voltage sold the correct link-jumper on CD3x00 board.



Warning: this procedure can be done just by specialized personnel.



Transformer Type	Link-Jumper J9+J11	Link-Jumper J10
TR-605 120V	90:130V	-
TR-605 230V	170:265V	300:530V
TR-605 300V	230:345V	510:690V

- The type of mounted transformer depends of the chosen Auxiliary Voltage in the order code. (See par. 5.2)
- If the Auxiliary Voltage (written on the identification label) is different from Supply Voltage (to the load), use an external transformer with primary equal to load voltage and secondary equal to the Auxiliary Voltage.

11.3 Analog inputs

CD3200 thyristor unit have an analogue input to drive the output and a second analogue input that can be use for external current profiling.



Before to operate on CD3200, make sure that the Power voltage and auxiliary voltage supply are not connected

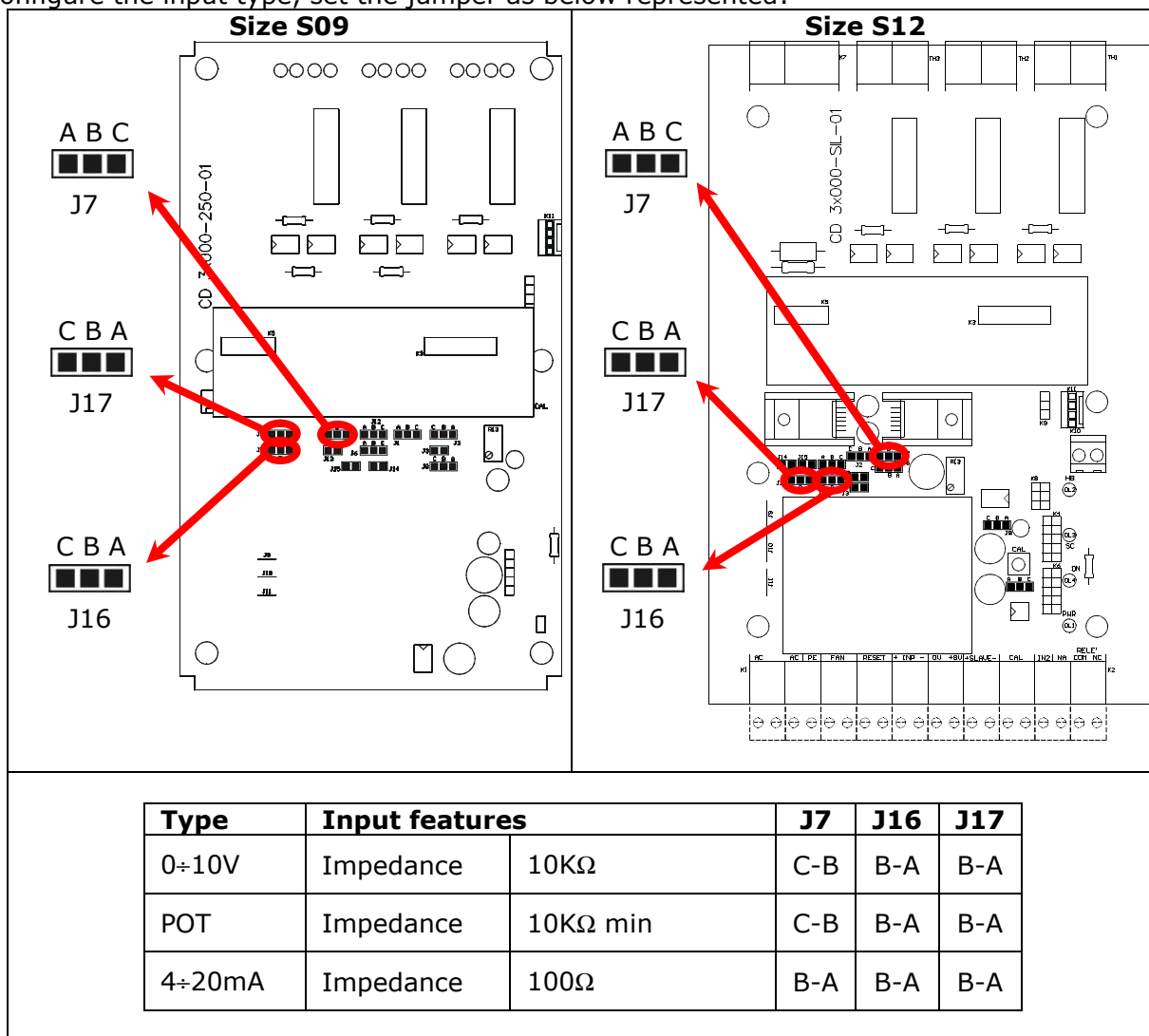
11.3.1 Input command signal configuration (Terminals 9+ e 10- see par. 7.3)

The Input command signal is already configured in line with customer requirements that are defined in the complete product code. The product code is written on the identification label. However, if you wish to change the input type (i.e. from 0÷10V to 4÷20mA) proceed as follows.



Warning: this procedure can be done just by specialized personnel.

To configure the input type, set the jumper as below represented:



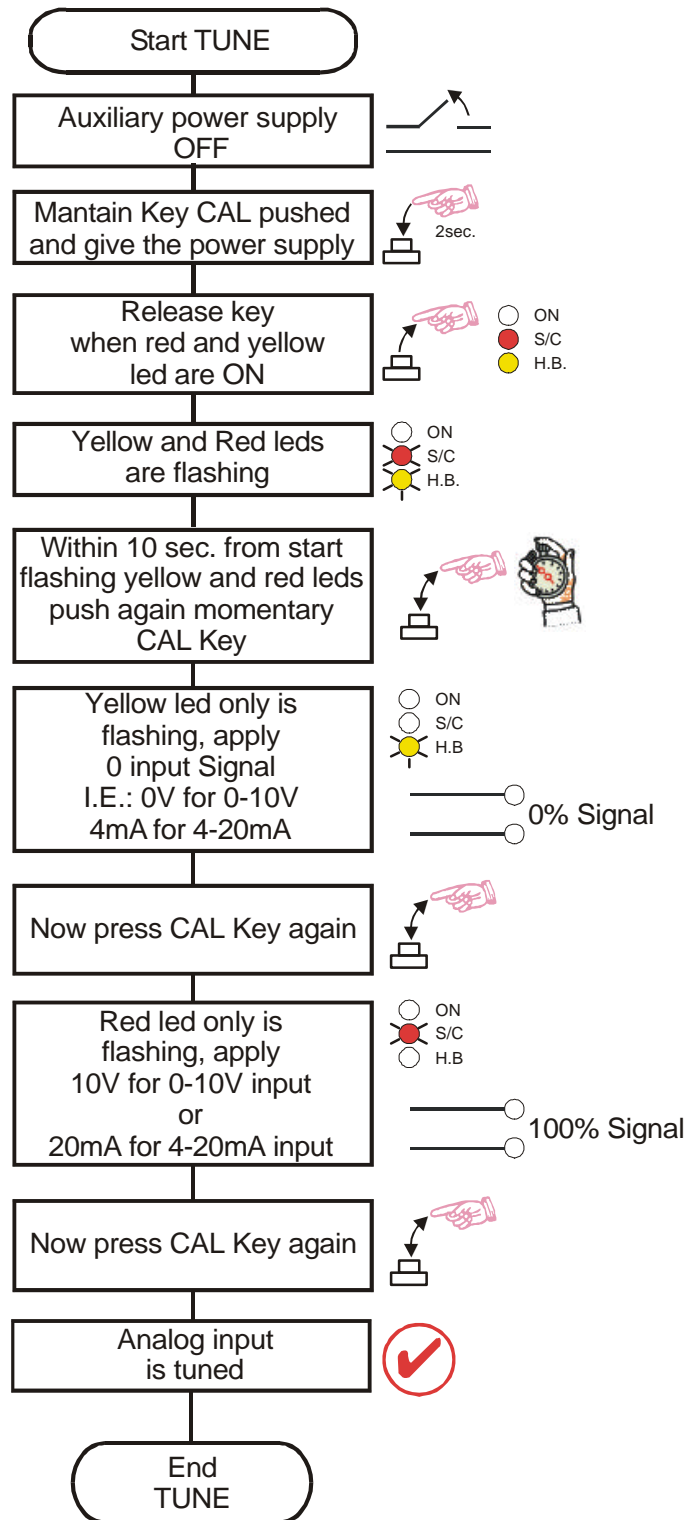
When operator finishes to configure the hardware setting he must do the input calibration procedure

11.3.2 Input calibration procedure



Warning: this procedure can be done just by specialized personnel.

This procedure is needed only if you change the input type



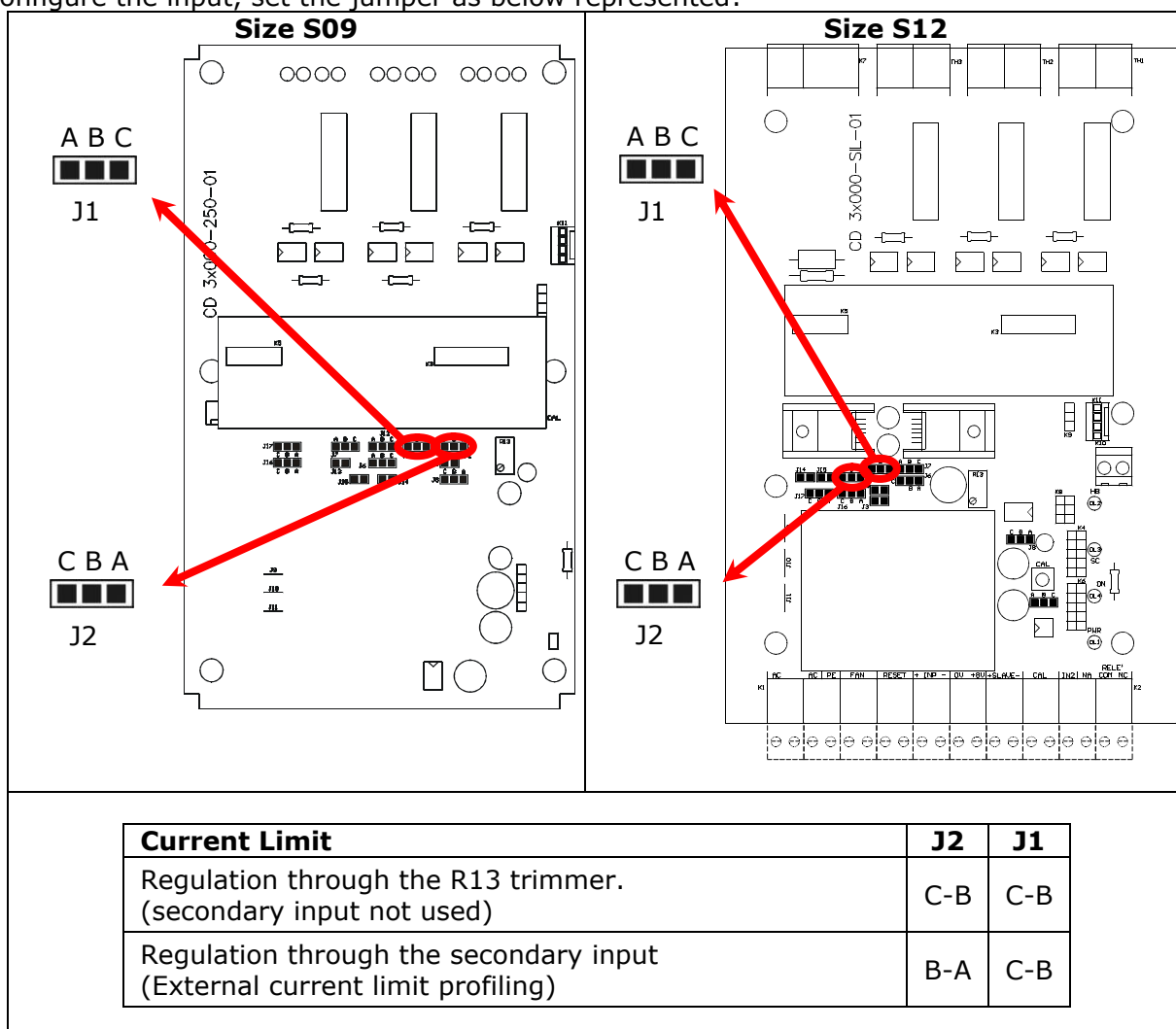
11.3.3 Secondary input (Terminals 11 e 17 see par. 7.3)

This analogue input 0-10V may be configured for External current limit profiling. The Secondary input is already configured in line with customer requirements that are defined in the complete product code. The product code is written on the identification label. However, if you wish to change the input type proceed as follows.



Warning: this procedure can be done just by specialized personnel.

To configure the input, set the jumper as below represented:



When operator finishes to configure the hardware setting he must do the calibration procedure (see par. 10.2.2)

11.4 Digital Input

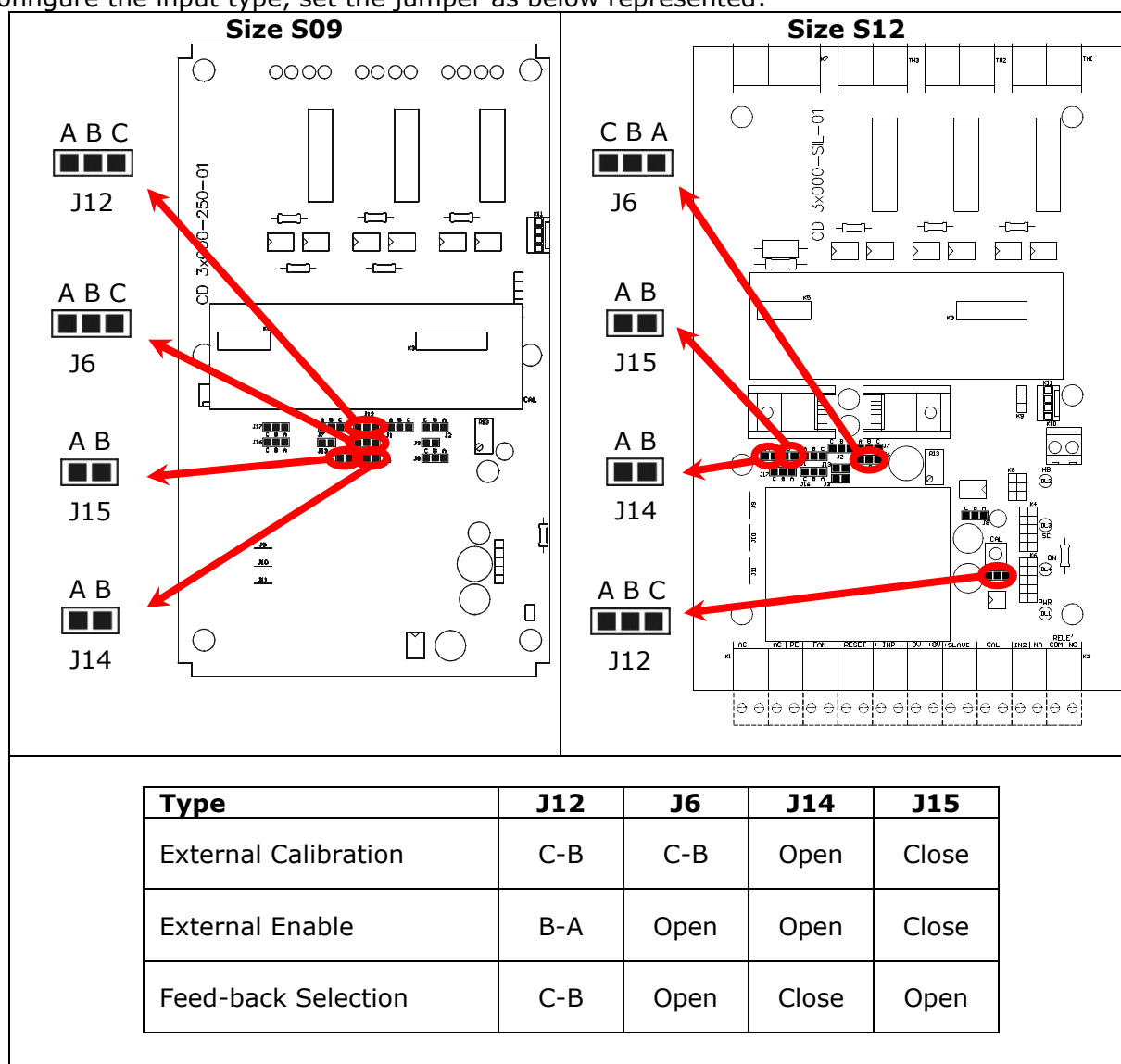
CD3200 thyristor unit has two digital inputs.

11.4.1 External Calibration (Terminals 15 e 16 see par. 7.3)

Supply with 24Vdc terminals 15-16 to start the calibration procedure (see par. 10.2.2)

Is possible configure the input also like:

- External Enable = to Enable or Disable the Unit.
Without Enable the out is always to zero and red led (SC) flashing, otherwise the out will follow the input signal.
- Feed-back Selection = to switch the set Feed-back with the voltage Feed-back (V)
Without Digital Input the Unit use the voltage Feed-back, otherwise use the set Feed-back.
to configure the input type, set the jumper as below represented:



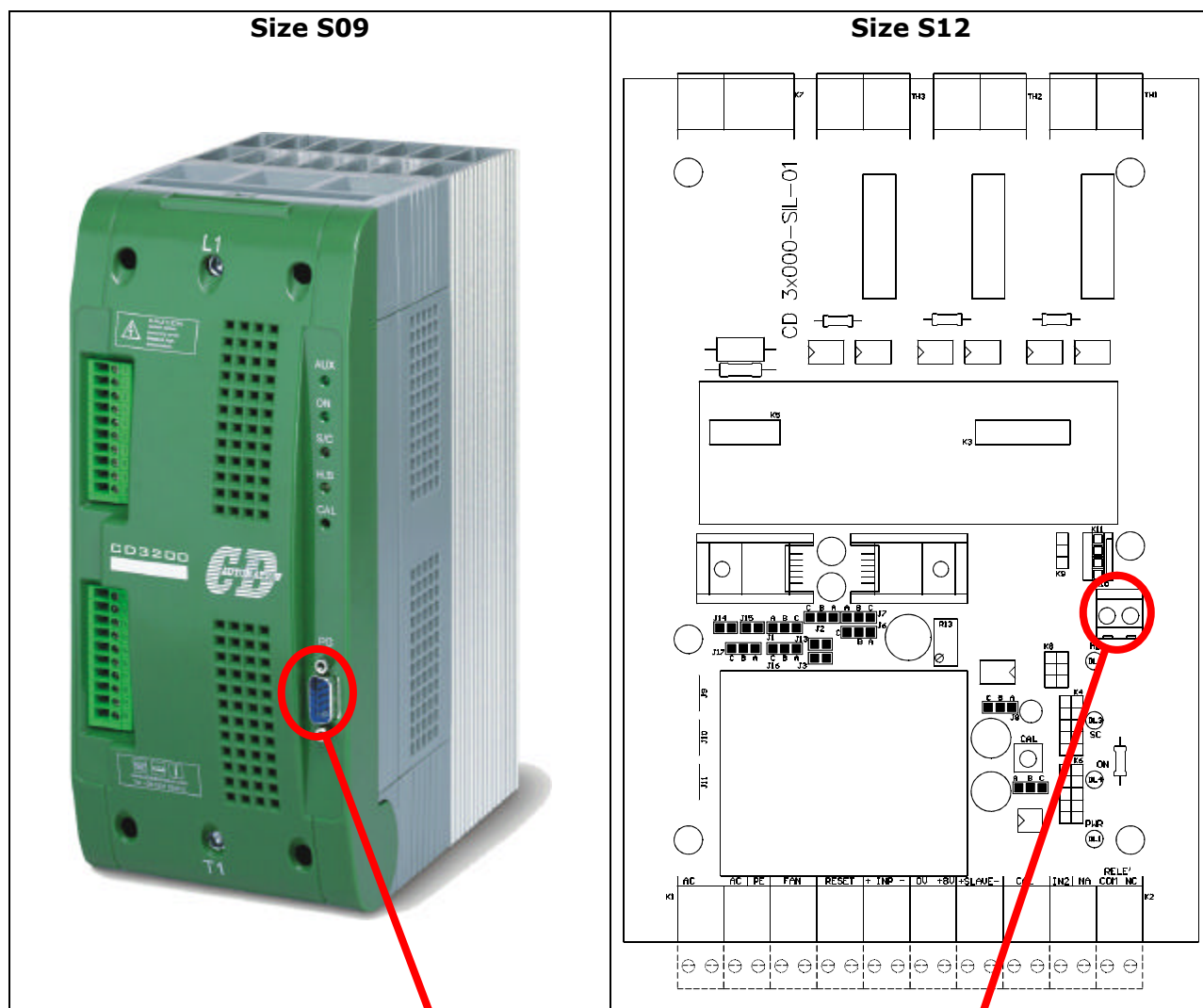
If you use the input like External Enable or like Feed-back Selection, is not possible use the input for the Calibration Procedure

11.4.1.1 Reset (Terminals 7 e 8 see par. 7.3)

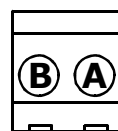
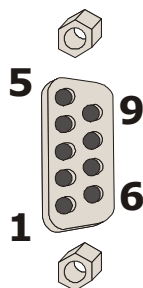
Open link to terminals 7-8 to stop the CD3200 thyristor unit.
When an alarm occurs use reset to clear the alarm (see par. 9.3).

11.5 RS485 serial connection

CD3200 have a serial communication port RS485.
On this port may be done a network up to 255 CD3200.



Pin 1	PMS5 (+5V)
Pin 2	GND 0V
Pin 3	GND 0V
Pin 4	Reserved (Rxd0)
Pin 5	GND 0V
Pin 6	RS485 A
Pin 7	RS485 B
Pin 8	nc
Pin 9	Reserved (Txd0)

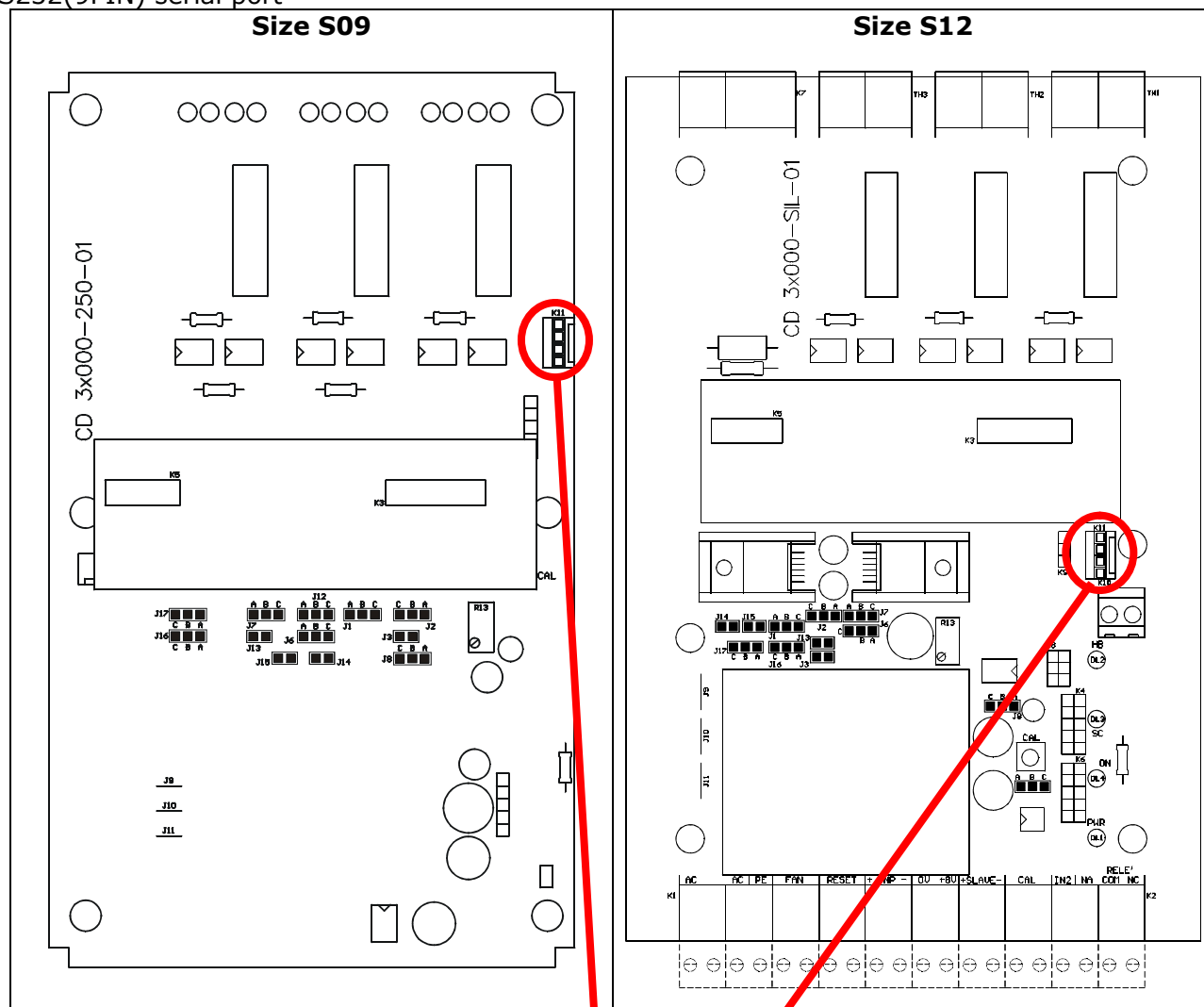


Terminal	Description
B	RS485 B
A	RS485 A

11.6 PG Connector

The programmer port (PG) is used to configure the thyristor unit with the configuration software and with the programmer cable.

Once removed the cover, put a side of cable in PG connector and the other side in the PC RS232(9PIN) serial port

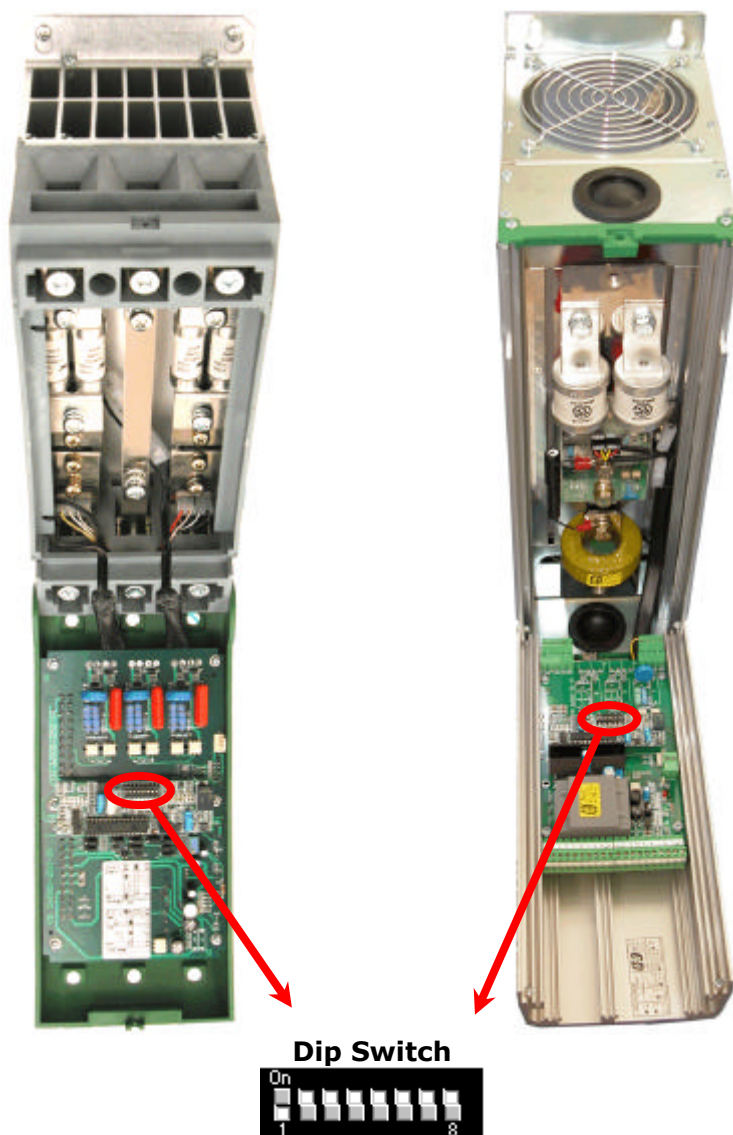


PG Connector



11.7 Address configuration

To configure communication address remove cover and set the dip-switch as below specified.



Convert the Address Number in Binary for Example: 150 Dec = 10010110 Bin
The dip switch number corresponds to the bit number:

Address Number	Dip Switch Number							
	8	7	6	5	4	3	2	1
150 Dec -> 10010110 Bin	1 (On)	0 (Off)	0 (Off)	1 (On)	0 (Off)	1 (On)	1 (On)	0 (Off)

For convert the Number in Binary you can use this method:

Dip Switch Number have this value:

	Dip Switch Number							
	8	7	6	5	4	3	2	1
Value	128	64	32	16	8	4	2	1

The Address Number Ex. 150 = 128(Dip 8) + 16(Dip 5) + 4(Dip 3) + 2(Dip2)

12 Fuses and Fuse holder

CD3200 unit are protected against short circuit by High speed fuses.
The fuses must be with proper I^2t lower than the thyristor one.



WARNING!! USE SEMICONDUCTOR FUSES ONLY WITH proper I^2t

12.1 Fuse Code

Size	200 kARMS Symmetrical A.I.C.				Qty
	Fuse CODE	Current (ARMS)	I^2T (A ² sec)	Vac	
125A (S09)	FU200FEE	200	11400	660	1
150A (S09)	FUURB250	250	52000	660	1
200A (S09)	FUURB315	315	7700	660	1
300A (S12)	FU350FMM	350	105000	660	1
400A (S12)	FU550FMM	550	215000	660	1
500A (S12)	FU700FMM	700	420000	660	1
600A (S12)	2xFU450FMM	450	105000	660	1
700A (S12)	2xFU450FMM	450	105000	660	1



Other Fuses at your choice must have I^2t 20% less than thyristor's I^2t .



High speed fuses are only used for the thyristor protection and can not be used to protect the installation.



The user installation must be protecting by electromagnetic circuit breaker or by fuse isolator.



The warranty of thyristor is null if no proper fuses are used. See tab above.



13 Modbus communication



The CD3200 is equipped with two-wire RS485- serial communication. This means that communication can be between the CD3200 and a master device (Ex. a computer or terminal).

13.1 Physical requirements

Character Transmission

Data format is fixed to be one start bit, eight data bits, one stop bit and the parity none.

13.2 Modbus Rtu Protocol

The standard RS485 Communications use the industry standard MODBUS RTU protocol.

The following restrictions are imposed:



- A baud rate is fixed to 9600 Baud only.
- Support for multi-parameter Write operations is limited to support of the Multi-Word Write Function (Number 16) but permits writing only one parameter per message.
- MODBUS Function 17 (Report Slave ID) is not supported.

The following MODBUS functions are supported:

Function	Function Number
Read Holding Registers (Read n Word)	03
Preset Multiple Registers (Write n Word)	16

13.3 Message formats

The first character of every message is the Controller address, in the range 1 - 255 and 0 for broadcast messages.

The second character is always the Function Number.

The content of the remainder of the message depends upon this Function Number.

In most cases the Controller is required to reply to the message by echoing the address and Function Number.



Broadcast messages are supported at address 0 (to which the CD3200 responds by taking some action without sending back any reply).

Data is transmitted as eight-bit binary bytes with one start bit, one stop bit and parity checking set to none. A message is terminated simply by a delay of more than three character lengths at the Baud rate used; any character received after such a delay is considered to be the potential address at the start of a new message.

Since only the RTU form of the protocol is supported, each message is followed by a two-byte CRC 16 (a 16-bit cyclic redundancy checksum).

This checksum is calculated in accordance with a formula which involves recursive division of the data by a polynomial, with the input to each division being the remainder of the results of the previous division.

The dividing polynomial is:

$$2^{16} + 2^{15} + 2^2 + 1 (\text{Hex } 18005)$$

But this is modified in two ways:

- because the bit order is reversed, the binary pattern is also reversed, making the most significant bit (MSB) the right-most bit;
- Only the remainder is of interest, the right-most (most significant) bit can be discarded.



Thus, the polynomial has the value Hex A001.

Bit order

Normal bit order

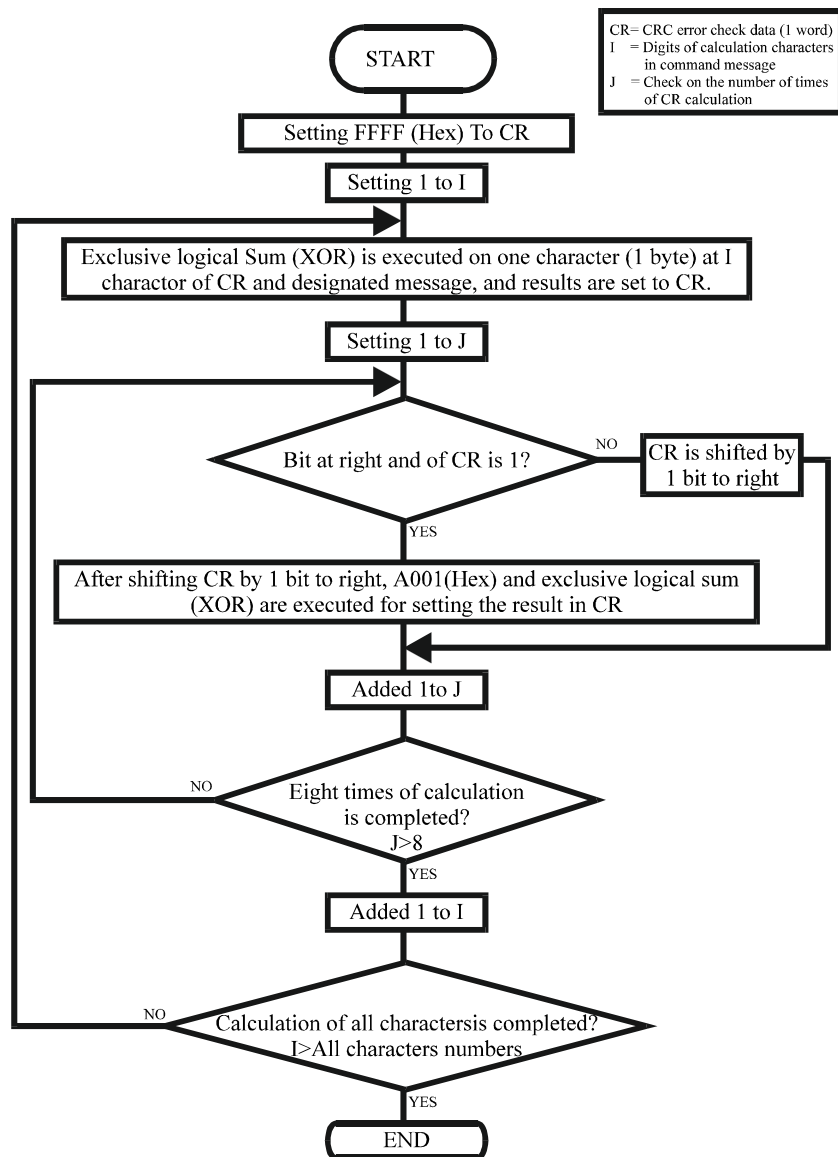
Most significant bit																		Least significant bit
Most significant byte								Least significant Byte										

Reversed bit order

Least significant bit																		Most significant bit
Least significant Byte								Most significant byte										



N.B.: Reversed order applies, so CRC16 returns Reversed bit order



C Language CRC 16 Example

```

static short CRC16 (unsigned char *p_first,unsigned char *p_last)
{
    unsigned int crc=0xffff;
    short j;

    for (;p_first<=p_last;p_first++)
    {
        crc ^= *p_first;
        for(j=8;j>0;j--)
        {
            if(crc & 0x0001)
            {
                crc = crc >> 1;
                crc ^= 0xA001;
            }
            else
            {
                crc = crc >> 1;
            }
        }
    }
    return (crc);
}
  
```

13.4 Read holding registers (read n words) – Function 03

The message sent to the unit to obtain the value of one or more registers comprises the following eight bytes:

Addr. Unit	Func.	Addr of 1° Word		N° of Word		CRC 16	
	3 3Hex	HI	LO	HI	LO	LO	HI

The normal reply will echo the first two characters of the message received followed by a single-byte data byte count (which will not include itself or the CRC).

For this message, the count value equals the number of parameter values read multiplied by two. Following the byte count, the specified numbers of parameter values are transmitted, followed by the CRC16 bytes:

Addr. Unit	Func.	Cont.	1° Value			Last Value		CRC 16	
	3 3Hex		HI	LO		HI	LO	LO	HI

13.5 Preset multiple registers (write n words) - Function 16

This is an eleven-byte message. Only one parameter may be written for each received message. The usual pre-amble is followed by the address of the parameter to be written, a two-byte word count (always set to 1), a single-byte byte count (always set to 2), the value to be written and the CRC16 bytes:

Addr. unit	Func.	Addr of 1° Word		N° of Word		Cont.	Valore		CRC 16	
	16 10Hex	HI	LO	0	1	2	HI	LO	LO	HI

The unit normally responds with the following eight-bit reply:

Addr. Unit	Func.	N° of Word		N° Word		CRC 16	
	16 10Hex	HI	LO	0	1	LO	HI

13.6 Error and exception responses

If a received message contains a corrupted character (parity checks failure, framing error etc.) or if the CRC16 check fails, or if the received message is otherwise syntactically flawed (e.g. byte count or word count is incorrect), the CD3200 will ignore that message.

If the received message is syntactically correct but nonetheless contains an illegal value, the CD3200 will send a five-byte exception response as follows:

Addr. unit	Func.	N.Exception	CRC 16	
			LO	HI

The Function Number byte contains the function number contained in the message which caused the error,

With its top bit set (i.e. Function 3 becomes 0x83) and the Exception Number is one of the following codes:

Code	Name	Cause
1	ILLEGAL FUNCTION	Function number out of range
2	ILLEGAL DATA ADDRESS	Parameter ID out of range or not supported
3	ILLEGAL DATA VALUE	Attempt to write invalid data/required action not executed



NOTE: Writing a parameter value equal to its current value is a valid transaction; this will not cause an error response.

13.7 Modbus parameters

P001L (H01)	Byte Lo = Load Voltage	R
Function:	This parameter show the Voltage rms value	
Min/Max:	0 ÷ 255 (0 ÷ FF Hex)	
Value:	Value depends on the Unit type	
P001H (H01)	Byte Hi = Load Current	R
Function:	This parameter show the Current rms value	
Min/Max:	0 ÷ 255 (0 ÷ FF Hex)	
Value:	Value depends of current transformer and from his size's	
Example:	With current transformer (CT) 150/0.05A, the max value corresponds to the max value of the CT: Read value=255 (FF Hex) -> Load Current= 150A	
P002L (H02)	Byte Lo = Set-point Voltage	R/W
Function:	This parameter is the Set-point voltage saved by the Calibration Procedure	
Min/Max:	0 ÷ 255 (0 ÷ FF Hex)	
P002H (H02)	Byte Hi = Set-point Current	R/W
Function:	This parameter is the Set-point of current below which HB alarm occurs	
Min/Max:	0 ÷ 255 (0 ÷ FF Hex)	
Value:	This value is the load current(P001H) minus % value of parameter P126H	
P003 (H03)	Status Table	R
Function:	It's a tab in bit that represent the "Status" of thyristor unit	
Value:	Bit 0 = 1 -> Short circuit on SCR Bit 1 = 1 -> Load Failure (HB Alarm) Bit 2 = 1 -> Output signal ON Bit 3 = 1 -> HB Calibration in progress Bit 4 = 1 -> Current Limit Flag Bit 5 = 1 -> Thermal switch	
P004 (H04)	Command Table	R/W
Function:	It's a tab in bit for remote commands via RS485	
Value:	Bit 0 = 1 -> Activate HB Calibration procedure Bit 1 = 1 -> Input Command from RS485 (see P005) Bit 2 = 1 -> Disable Output signal (Only with Input from RS485) Bit 3 = 1 -> Reset HB Alarm Bit 4 = 1 -> Current Limit via RS485 (see P007)	
Note:	When unit is switch off all command parameter are set to 0	
P005L (H05)	Byte Lo = Input command signal	R
Function:	This parameter reads the Input command signal (see par.7.3) When the P004 Bit1 =1 This parameter could be written and become the Input Command from RS485	
Min/Max:	0 ÷ 255 (0 ÷ FF Hex)	
Example:	Input 4mA -> P005L = 0 (0%) Input 12mA -> P005L = 128 (50%) Input 20mA -> P005L = 255 (100%)	

P005H (H05)

Function:

Min/Max:

Example:

Byte Hi = Ramped Input command signal**R**

This parameter reads the Input command signal after the ramp

0 ÷ 255 (0 ÷ FF Hex)

Input 4mA -> P005H = 0 (0%)

Input 12mA -> P005H = 128 (50%)

Input 20mA -> P005H = 255 (100%)

P006 (H06)

Function:

Min/Max:

Value:

Note:

Power adjust**R/W**

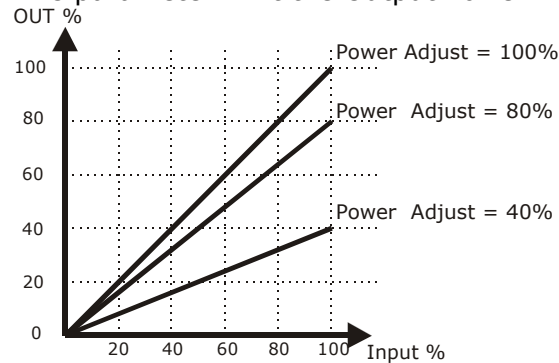
It's a scaling factor of the Input command signal

0 ÷ 255 (0 ÷ FF Hex)

from 0 = 0% of Output,

to 255 = 100% of Output.

This parameter limit the Output Power

**P007 (H07)**

Function:

Min/Max:

Value:

Example:

Current Limit**R**

This parameter show the Current Limit value (see par. 10.2.2)

When the P004 Bit4 =1 This parameter could be written and become the Current Limit from RS485

0 ÷ 255 (0 ÷ FF Hex)

Value depends of current transformer and from his size's

With current transformer (CT) 150/0.05A, the max value corresponds to the max value of the CT:

Read value=255 (FF Hex) -> Load Current= 150A

P121 (H79) Function: Value:	CD Unit ID This parameter Identify the CD type Family CD32 Hex = CD3200 Family	R
P122 (H7A) Function:	CD Ver This parameter is for internal use	R
P123 (H7B) Function: Min/Max: Value: Note:	Password This parameter give the access to configuration 0 ÷ FFFF Hex 9357 Hex = Writing parameters activated any value = Writing parameters disabled When the CD3200 comes out and then re-lighted, for change the parameters you must re-insert the password.	R/W
P124 (H7C) Function: Min/Max: Value:	Actual power This parameter show the actual value of the power demand 0 ÷ FFFF Hex from 0 = 0% output power, to 65535 = 100% output power.	R
P125L (H7D) Function: Value:	Byte Lo = Feed-Back Type This parameter set the Feed-Back Type 00 Hex = V2 20 Hex = V 40 Hex = I 80 Hex = VxI	R/W
P125H (H7D) Function: Min/Max: Value:	Byte Hi = Tempo di Soft start The Unit start with a ramp that progressively increase the thyristor firing angle up to arrive to final value. The time is setted by this parameter 0 ÷ 255 (0 ÷ FF Hex) Each step is 50msec	R/W
P126L (H7E) Function: Min/Max: Value: Note:	Byte Lo = HB Delay time This parameter set a delay to have HB alarm active 0 ÷ 255 (0 ÷ FF Hex) Each step is 50msec If Soft start option is enabled HB Delay time must be greater than Soft start time: P126L x 50msec > P125H x 50msec	R/W
P126H (H7E) Function: Min/Max: Value: Note:	Byte Hi = HB sensibility This parameter is the maximum reduction of Load Current to establish the HB Alarm 0 ÷ 100 (0 ÷ 64 Hex) Each step is 1% from Nominal Current When you change this parameter, HB Calibration procedure is necessary.	R/W
P127 (H7F) Function: Min/Max: Value:	Power Set This parameter show the Power set saved by the Calibration Procedure 0 ÷ FFFF Hex from 0 = 0% output power, to 65535 = 100% output power.	R/W

P128L (H80)**Byte Lo = Integral****R/W**

Function:

This parameter is the integral time of the feed-back loop

Min/Max:

0 ÷ 255 (0 ÷ FF Hex)

Default:

50 Hex

Note:

If you increase integral time you increase the output stability, but you increase also the time to reach the set.

P128H (H80)**Byte Hi = Proportional****R/W**

Function:

This parameter is the gain of the feed-back loop

Min/Max:

0 ÷ 255 (0 ÷ FF Hex)

Default:

VxI or V2 = 5 Hex

V or I = 12 Hex

Note:

This parameter increase the loop speed but decrease the loop stability.

14 Maintenance

14.1 Trouble Shooting

Small problems sometimes can be solved locally with the help of the below tab of trouble shooting. If you don't succeed, contact us or your nearest distributor

Symptom	Indication on front unit	Possible reasons of the symptom	Actions
Thyristor unit doesn't go in conduction with input signal	Green LED (Aux) is always light off	<ul style="list-style-type: none"> No voltage auxiliary power 	<ul style="list-style-type: none"> Give auxiliary voltage supply (see wiring diagram)
	Green LED (Aux) light on Green LED (ON) light off	<ul style="list-style-type: none"> No input signal Reversed polarities of input signal Reset contact is open 	<ul style="list-style-type: none"> Provide to give input signal Reverse the input signal polarity Make link on reset terminals (see wiring diagram)
	Green LED (Aux) light on Green LED (ON) light on	<ul style="list-style-type: none"> Fuse failure Load failure Load connection interruption Thyristor faulty and always in open circuit With HB option the yellow led (HB) is light on	<ul style="list-style-type: none"> Substitute the fuse Check the load Check the wiring Substitute the faulty thyristor
Load current flows also with no input signal	Green LED (ON) is always light off.	<ul style="list-style-type: none"> Wrong wiring Short circuit on thyristor If there is HB option the red LED (SC) is light on	<ul style="list-style-type: none"> Check the load wiring Substitute the thyristor
Current flows at nominal value but Yellow LED (HB) is light on	Yellow LED (HB) light on	<ul style="list-style-type: none"> HB circuit not tuned Current transformers not properly wired 	<ul style="list-style-type: none"> Make HB calibration procedure Control current transformers wiring
Current flows at nominal value but Red LED (SC) is light on	Red LED (SC) light on	<ul style="list-style-type: none"> HB circuit not tuned 	<ul style="list-style-type: none"> Make HB calibration procedure
Thyristor unit doesn't work properly		<ul style="list-style-type: none"> Wrong input signal selection. Wrong input signal calibration (out of range). Auxiliary voltage supply out of limits 	<ul style="list-style-type: none"> Control input signal setting. Repeat input calibration procedure. Verify the auxiliary voltage supply

14.2 Fans

The thyristor unit with forced ventilation uses fans that rotate permanently when the unit is supplied. In case of accidental fan failure, there is an over heating temperature on heatsink. In this case to give protection to thyristor there is a thermal switch properly setted. The function of this switch is to open the input signal until the heatsink temperature falls below the setted value. This means that also with input signal in ON condition the unit is switched OFF and the system can not work at full power. For this reason is important to control periodically the fans status checking that are rotating.

14.3 Servicing

In order to have correct cooling, the user must clean the heatsink and the protective grill of the fans. The frequency of this servicing depends on environmental pollution. Also check periodically if the screw for the power cables and safety earth are tightened correctly.

14.4 Repairing procedure

- Phone to CD Automation.
- Explain to Service Engineer the problem because sometimes it can be solved with a phone call. If this is not possible, ship the unit to CD Automation or to your distributor.
- Write a fault description and give the name of your personnel to which refers.
- Use a rugged packaging to ship the unit.

14.5 Warranty condition

CD Automation gives a 12 months warranty to its products. The warranty is limited to repairing and parts substitution in our factory and does exclude products not properly used and fuses. Warranty does not include products with serial numbers deleted. The faulty product should be shipped to CD Automation at customer's cost and our Service will evaluate if product is under warranty terms.

Substituted parts remain of CD Automation property.

15 CD Automation's distributors

For a more precise and rapid service, please contact the distributor nearest to you:

ITALY	
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16 Note

